ANTISEPTIC THERAPEUTICS.

BY

DR. E. L. TROUESSART,

PARIS, FRANCE.

TRANSLATED BY E. P. HURD, M.D.

VOLUME I.

1893.

GEORGE S. DAVIS,

DETROIT, MICH.

TABLE OF CONTENTS.

CHAPTER II.

Antiseptics Borrowed from Organic Chemistry.

Résumé and Conclusions.

Appendix.

TRANSLATOR'S PREFACE.

The work of Trouessart on Antiseptic Therapeutics, which forms Volume XXI of the Charcot-Debove series, is here reproduced because, in the judgment of the translator, it is the best treatise on the above subject that has yet appeared. The recent great advances in Bacteriology, and the increasing prominence in medicine, surgery, and obstetrics given to Antiseptics, have created a demand for a work of this kind.

While it is admitted that the subject of antiseptic therapeutics is still in an undeveloped condition, yet tentatives to supply a present want are always in order. Possibly men of the next decade will declare this treatise to be antiquated and behind the times. It may be that the progress of the next decade will be away from pharmaceutical antiseptics in the direction of serotherapy. Certain it is, however, that the problem will still continue to be—how to formulate an internal antiseptic medication that shall not injure the living cells and tissues of the organism.

The author of this book is a well known authority on Fungi. He is the author of a book on MICROBES, FERMENTS AND MOULDS, which constitutes Vol. LVII of the International Scientific Series.

The translator has generally given the formulæ as they stand in the original work. It is surely time that all the physicians of this generation were educated up to the decimal system of pharmacy.

E. P. HURD, M. D.

Newburyport, Mass.

ANTISEPTIC THERAPEUTICS.

INTRODUCTION.

The profound revolution which has been accomplished in the study of general diseases by the discovery of microscopic organisms (microbes or bacteria) which are incontestably the cause of a great many of them, cannot fail to have its influence on the treatment of diseases. This result, however, has been a little slow to come about, and one cannot but be struck with the difference which still exists in this respect between surgery and general medicine.

On the one side, antisepsis and asepsis considered as indispensable, and imposed as an absolute rule, not only in surgical operations properly so called, but also in gynæcological practice, in obstetrics, in ophthalmology, and in rhinology.

On the other side, the treatment of internal diseases remaining almost the same as it was twenty years ago, or making but indecisive and timid borrowings from the antiseptic method.

Even in the numerous cases where there remains no doubt as to the microbian nature of the affection, physicians do nothing or do very little to combat the injurious action of the microbes or of their products (*toxines*), and the suffering organism has the conflict to sustain unaided. Antisepsis is not yet, as it ought to be, the first and the principal preoccupation of the physician as it is that of the surgeon.

The reasons of this difference are multiple, and pertain to the very nature of the mode of interven-

tion. Clinicians have asked in earnest if the antiseptic when introduced into the digestive tube is not much more dangerous than when it is simply applied to the skin or upon a solution of continuity thereof. This objection might have had greater weight at an epoch when physicians knew hardly any antiseptics but corrosive sublimate and phenic acid. It has hardly any force now that our therapeutic arsenal possesses an admirably graded series of products borrowed for the most part from organic chemistry (aromatic series), which, to quote Bouchard's expression, are in determined dose toxic for such and such a microbe, and not toxic to any of the animal cells.

The microbian theory, moreover, by reason of recent advances, is undergoing a remarkable evolution, of which it is necessary to speak briefly, for it directly concerns the question of the internal employment of antiseptics.

The microbes, we know, do not act solely by their presence, like a parasitic plant which derives its nutriment from the organism in which it is implanted. Their action is more complex. Most of them, and particularly the most dangerous—those of cholera, of tetanus, and of diphtheria, for instance—act especially by their products of secretion (toxines), liquids analogous to the venoms and diastases, veritable poisons, poured into the organism and carried by the blood to the nervous centres even before the multiplication of the parasite has assumed proportions corresponding in degree to the acuteness of the general symptoms which indicate a rapidly fatal affection.

It is not, then, so much the microbe itself as its toxine-producing function which constitutes the dan-

ger; and experience shows that it is not necessary to administer the antiseptic in massive doses capable of destroying the microbe – a dose relatively feeble suffices to neutralize the action of the latter, *i.e.*, to prevent its multiplying and producing the toxine which is peculiar to it. Thereupon the organism, rid of the poison which was paralyzing its normal functions, gets the better of the microbe, which is speedily eliminated, and the patient recovers his health.

But we may go farther, and enlarge considerably the field of antiseptic medication. In a great number of diseases we observe all the symptoms which ordinarily characterize the microbe-diseases, but we have not been able to discover any microbe to which might be attributed the origin of the affection. Such are the inflammations consecutive to alterations of nutrition; of these, acute rheumatism is the most complete type.

The cause of these diseases is a perversion of the functions of certain cells of our tissues and organs —cells which pour into the economy abnormal matters, or even normal ones in exaggerated proportion. These matters constitute veritable toxines whose effects are similar to those of the toxines fabricated by the pathogenic microbes. This similarity is a fact which should not cause surprise. The natural history of the cell, histological element of all our tissues, shows that it possesses an organization and properties similar to those of the microscopic animal or vegetal cells which live as parasites in the organism and are designated under the general name of microbes. The former, when perverted in their function, diseased, become thereby veritable parasites, foreign bodies, which the organism hastens to eliminate by the well known processes of inflammation, just as it does in dealing

with the microbes. This is why the general symptoms (hyperthermia, nervous troubles, etc.) are the same in both cases.

The elimination of these toxines, whatever may be their origin, is effected by the kidney, by the intestine, or by the skin; and this it is that explains why fever is lighted up whenever the kidney is overworked or its functions impeded, as is often the case in inflammations. This also explains why diuretics, purgatives, and sudorifics have a favorable and truly antiseptic action in all the inflammations, because they remove not only the toxines secreted by the microbes and by the altered cells, but also the microbes themselves and these dead or dying cells, true débris of the organism, which now only serve to encumber the organs, and which form in the circulatory stream, and more particularly in the kidney, obstructions which constitute an immediate danger to the entire economy.

We know, in fact, that the kidney is the principal and almost the only door of exit for the microbes which multiply in the blood. This explains the frequency and the danger of the nephrites in general, and of the infectious nephrites in particular.

But this notion also gives us valuable indications from a therapeutic point of view, and experience shows that the antiseptics act on the diseased cells, as on the microbes, by neutralizing their noxious action —by disinfecting them, as we used to say; by preventing them from secreting toxic substances, as we say today. In fact, the antiseptics act on the inflamed cells of our internal organs just as they do on the cells of superficial wounds, and in both cases the rapid return of the tissues to the normal state is the consequence of an antisepsis rational and proportionate to the gravity of the lesion.

It is, however, well to bear in mind that if the inflammation may be frank, non-microbian, yet the microbe is everywhere present—it may be *dormant*, but ready to revive and grow and destroy when the conditions become favorable. The trouble of the organism—the traumatism, the inflammation—may open the door to the parasite. Hence the complications, unceasingly menacing, which insidiously transform a simple and curable inflammation into an infectious, and it may be rapidly mortal, disease.

Acute articular rheumatism, a disease which is not essentially microbian, is one of the affections in which complications of a disastrous kind are frequent; and without speaking of secondary or *pseudo-rheumatisms* consecutive to blennorrhagia, to scarlatina, to dysentery, to mumps, to puerperal affections, have we not sometimes observed as a sequel of a simple otorrhœa of long standing, an articular pseudo-rheumatism, rapidly fatal, without cardiac complications, although confounded by its symptoms of invasion with ordinary acute rheumatism? It is important, then, from the onset of any inflammatory disease, even supposing it to be a simple cyclical affection, to institute an antiseptic treatment proportioned to the gravity of the symptoms. And whether the medicament acts as an aseptic, *i.e.*, as a prophylactic agent, or as an antiseptic, *i.e.*, a curative agent, whether it neutralizes the toxic action of the microbes or that of the degenerate cells of our own tissues, its useful action will be none the less easy to recognize. It is when the kidney, obstructed or inflamed, badly performs its functions, and the toxines thrown back on the intestine threaten it with inflammation, that it is eminently necessary to protect the vast absorbent surface which this organ offers. The antiseptic med-

ication then comes powerfully to the aid of the milk diet and purgatives, which cannot be indefinitely repeated without causing a new danger.

In fine, the reactions of our inner tissues (inflamed mucous and serous membranes, etc.) in presence of foreign substances (desquamated cells, microbes, or toxines) are not different from the reaction of the subcutaneous connective tissue when laid open by a wound; and the same treatment should apply to both cases.

But we have to take account in internal medicine of the special conditions of the inner environment, and of the difficulty of bringing a medicament to bear on the organ or organs inflamed. In most cases we have to be content with aiming at *general antisepsis;* but the *local antisepsis* will often follow as a consequence of this, and the final result will be only the more surely attained.

Before pursuing this study any farther, it will be well to take a glance over the changes which have been effected in the description of diseases which pertain to internal pathology by the recent progress in bacteriology.

GENERAL CONSIDERATIONS ON THE MICROBIAN DISEASES.

The general infectious diseases which are exclusively caused by the presence of a specific microbe may be either acute or chronic.

In the first class are diphtheria, tetanus, mumps, glanders, typhoid fever, typhus, cholera, yellow fever, epidemic cerebro-spinal meningitis, the sweating sickness, influenza, pertussis, blennorrhagia, etc.,

—diseases produced by microbes of a vegetal nature belonging to the family of *Bacteriaceæ.**

Intermittent fever (malaria), and some other affections more localized (vegetant folliculitis, Paget's disease), have for their cause microscopic organisms of an animal nature belonging to the class *Sporozoa.*

The general chronic diseases caused by bacteria are tuberculosis, leprosy, actinomycosis, rhinoscleroσis, beri-beri, dental caries. We should doubtless add syphilis and canine rabies.

Other diseases, the microbic nature of which has only recently been recognized, are peculiar in that they are either caused or complicated by the presence of numerous microbes (microbic associations), of which one or more species may predominate, according to the case. Such are certain forms of pneumonia and of pleurisy, bronchitis, meningitis, peritonitis, dysentery, etc., as well as erysipelas, lymphangitis, phlebitis, pyæmia, septicæmia, gangrene, the puerperal inflammations, metritis, etc., and all the general diseases consecutive to wounds—diseases which belong to both medicine and surgery and are often characterized by the presence of pus.

To go a step farther, we find in the train of these and other diseases such affections as the endocardites, the myocardites, the infectious nephrites, the metastatic abscesses, and the purulent arthrites, analogous to those mentioned above in connection with infectious pseudo-rheumatism.

As will be seen, the field of microbiology is vast, but it would be wrong to give it an exaggerated ex-

---

*Smallpox, measles, scarlatina, are doubtless microbe diseases, but their specific microbes (probably micrococci) have not yet been discovered and cultivated.

tension on the supposition that it includes all pathology. The affections not microbic are more numerous still, for they comprehend all the neuroses, the dyscrasiæ, the neoplasms, and even many inflammations which are due to physical and chemical causes foreign to the virulent action of the microbes. At the same time these affections, by debilitating the organism and vitiating the functional activity and histological renovation of the organs, open the door to microbic complications. Antiseptic treatment is then as urgently demanded as if the primary disease were of an infectious nature, whether to combat the deleterious effects of the toxines secreted by the organism itself, or to fortify the organism against complications from without.

In all cases it is important to distinguish between microbic and non-microbic diseases; to know to what particular species the pathogenic bacterium belongs; and, when the infectious disease is a complication, to determine at what precise moment the microbe makes its appearance. This is the object of that new science called Bacteriology.

Without doubt, the constant resort to the microscope as an indispensable aid to the diagnosis and prognosis of diseases is a hardship to the ordinary practitioner whose early teaching may have lacked expert training in this regard, and who is used to the traditional methods; but just such difficulties have always been encountered in the beginning of scientific progress in all departments.

What auscultation was to the physicians of the first third of this century, what the cell theory was twenty-five years later to the succeeding generation, the microbian doctrine is to the practitioners of to-day.

Histology has shed a brilliant light upon the diagnosis of all those neoplasms which were once confounded under the common names of tumors and cancers. So, also, bacteriology has given a new illumination to the pathology of inflammatory processes, and the definitive triumph of the microbic theory will be the advancement of clinical medicine.

How many problems, remaining unsolved by the ancient methods of diagnosis, are now made plain by the aid of the microscope!

Why, for instance, is meningitis curable in certain cases, and fatal in others? It is because the tubercle bacillus is not the sole cause of the disease, but other microbes (as the pneumococcus) may produce it in a much less malignant form.

Likewise, not all the pseudo-membranous anginas (formerly confounded under the general name of diphtheria) are caused by the Klebs-Loeffler bacillus, for there is a pneumococcus-diphtheria which is relatively benign. On the other hand, the pseudo-membranous angina of scarlatina is due either to the Klebs-Loeffler bacillus (Cornil and Babes) or to the pus-streptococcus (Wurtz and Bourges), the latter being especially active in early angina. Thus we see that the same inflammatory process may be produced by different microbes, each tissue having but one way of defending itself against the irritation produced by the presence of parasites and their toxines. The nature and virulence of these toxines has, moreover, the greatest influence on the final issue of the disease. Some epidemics of diphtheria may be due to the true Klebs-Loeffler bacillus, of which the toxines are very virulent; these epidemics may prove to be very fatal. In other and far milder epidemics, less malignant microbes may predominate, and the success of the

practitioner will be greater. The pseudo-diphtheritic anginas are sufficiently common.

Again, in presence of acute inflammatory swellings of the joints, we must be prepared to diagnose between acute rheumatism and infectious pseudo-rheumatism, a much more serious and intractable malady.

The nosography of internal diseases must, then, be entirely reconstructed in the light of modern bacteriology. This work of revision is begun on all sides, and the results already obtained are such that we can foresee that it will be far advanced in a few years. Hardly ten years have elapsed since the first attempts to construct a microbian pathology were made; much has been accomplished, and many of the principal difficulties have been overcome. Under the stimulus of the new pathology, chemists are every day enriching the materia medica with new antiseptics, and the future is full of promise.

GENERAL CONSIDERATIONS ON THE ANTISEPTIC MEDICAMENTS.

We are indebted to the microbian theory for the clearer light which we possess to-day as to the true mode of action of those medicines, at first employed empirically, which have long been designated as *specifics: e. g.*, mercury in syphilis, and quinine in malaria. These medicines are in reality *antiseptics*, and do good principally because they antagonize the microbes which engender the diseases. They are so little specific that one of these salts, the bichloride of mercury, may be considered as the most powerful agent of general antiseptic therapeutics. As for quinine, its tonic action is probably closely linked to its antiseptic action.

The microbic theory has enabled us better to comprehend the mode of action of a great number of medicaments, and, consequently, to define and extend the therapeutic indications. Instances of the suggestive value of the microbic doctrine in practice could easily be multiplied. Let us suppose the physician has to do with a phlegmon or a lymphangitis: under the influence of the old-time notions he would prescribe an antiphlogistic treatment, and would lose valuable time in the application of poultices and other emollients; but if, on the other hand, he is well imbued with modern ideas and convinced of the microbic nature of the lesion, he will employ immediately the antiseptics. Carbolic sprays or mercurial inunctions will speedily promote resolution of the inflammation, while the old antiphlogistic method would only result in suppuration, abscesses, and the necessity for surgical interference.

CLASSIFICATION OF MEDICAMENTS.

Considered from the point of view of their mode of action on the organism, and in a general manner, therapeutic agents may be divided into three great classes:

1. Medicaments which act directly on the organism itself, in modifying the altered functions of the organs in a manner favorable to a return to the normal state; such are the alkaloids, and all agents of a like kind, medicaments which we call *eusthenic* (from two Greek words: ευ, *well*, and σθενος, *force*).

2. Medicaments designed to prevent any constitutional effect from the alterations undergone by the organs; such are calmatives and palliatives; we designate them under the name of *hypnotics*.

3. Medicaments which do not act directly on

the organism itself, but on foreign matters thrown out by the tissues or originating from without the organism (microbes, exudates, toxines); these are *antiseptics.*

The eusthenics are supposed to act on the cells of the organs, and generally on healthy cells, which alone can respond by modification of function. The eusthenics, of all medicines, act most energetically on the organism itself.

Hypnotics act principally on certain special cells —the nervous cells—and their effect is to interrupt momentarily the communication existing between the sick organ and the cerebrum, so as to suppress pain.

Antiseptics act differently. Their action is directed for the most part against the agents of the disease coming from without, or against cells which, though formerly part of the economy, have by the fact of disease become foreign thereto and injurious. In short, the antiseptic medicament is addressed directly to the cause of the disease; and if it does not always reach this from the onset, it at least prevents this cause from prolonging and increasing its effects. Thus antisepsis realizes better than any other therapeutic method the desideratum so long sought as the Utopia of medicine, the *jugulation* of acute diseases.

If we were disposed to classify therapeutic indications according to their importance, we should arrange them in the following order:

1. Antiseptic therapeutics.
2. Eusthenic therapeutics.
3. Hypnotic therapeutics.

It is evident that a good system of treatment will aim to carry out, simultaneously or successively, the three indications which should present themselves to the mind of the physician precisely in the order in

which we have just mentioned them: (1) indications furnished by the cause which has produced the disease; (2) indications furnished by the diseased organism and the greater or less resistance which it offers to the disease; (3) indications furnished by the element of pain.

I hardly need say that there are medicines which by their complex action belong to all three of these groups. Such, for instance, is antipyrin (analgesin), whose action as a hypnotic and as a hypothermic (eusthenic) is well known, but which possesses besides, like all the products of the aromatic series, an incontestable antiseptic action.

Besides, in fortifying the organism by a judicious eusthenic treatment, and in preventing suffering, you will indirectly prescribe antiseptic medication, and enable the organism better to resist the causes of infection which threaten it. This is what is designated in a general way as "physiological therapeutics."

DEFINITION OF ANTISEPTICS.

A complete and general definition it is hard to give. To the chemist, antiseptics include all means capable of preventing fermentations and putrefactions by killing or stopping the development of the microbes which are their cause.

Vallin, in his Treatise on Disinfection, regards as antiseptics only those substances which prevent the decomposition of matters susceptible of putrefaction; he calls those drugs *neutralizers* that destroy or render inert virus and miasms, *i. e.*, microbes. According to Le Gendre, this distinction is no longer justified, as the progress of microbiology renders more and more subtle the difference between putrid infections and virulent diseases.

As the *toxines* constitute the principal danger, a comprehensive definition must not overlook them; and we may therefore say that the antiseptic medication is that which has for its end the destruction of the microscopic organisms which find entrance into the economy, and the septic principles which are developed under their influence or from any other cause.

Yet the chemical nature of virus, of soluble ferments, and of toxines is still so little understood that in most cases it is impossible for us to indicate what might be properly called their antidote. We are therefore obliged to rely on the antiseptics which act only on the microbes, producers of these toxines; at the same time we cannot refuse the name of antiseptics to medicaments which act similarly on the degenerate cells of the organism, for these also secrete toxines, as we have said above.

We ought also, by extension, to apply the name of antiseptics to therapeutic agents employed to combat the virulent action of toxic substances (soluble ferments, animal venoms) introduced into the organism under a liquid form and without the figured element (cell or microbe) which gave origin to them.

But therapeutic agents designed to combat the *poisons* properly so called—chemical substances of mineral or organic origin—are not classed as antiseptics, but *antidotes*.

Bouchard's definition, "An antiseptic is anything which directly impresses the life, multiplication and functioning of a microbe, *i. e.*, in doses inoffensive to man,"* seems to me not sufficiently general in the present state of science. Instead, I think the fol-

* Bouchard, *Therapeutique des Maladies Infectieuses*, pp. 84 and 119.

lowing more definite and practical: *Antiseptic medicaments are such as are calculated to destroy or to arrest the development of microbes which have found entrance into the organism, and to neutralize the action of the septic principles developed as a consequence of the presence of such microbes or from any other cause, or introduced ready-formed from without.*

The antiseptics actnally in use are either medicaments anciently known and empirically employed under the name of "disinfectants" and "specifics," or substances recently introduced into the materia medica by the progress of modern chemistry.

These therapeutic agents have a double action: on the organism of man, and on the pathogenic microbes. To estimate precisely this double action, we begin by experimentally testing these chemical products in our laboratories; such experiments are of two, and even three, sorts:

One set of experiments makes known the action of the product in question on a given pathogenic microbe sown in a culture field of artificial liquid having a chemical composition similar to that of the liquids which the microbe meets in the organism.

Another series is instituted to determine the toxic action of the same product on animals of an organization more or less like that of man (hares, guinea-pigs, etc.), in order tentatively to ascertain the maximum dose which can be administered without danger to these animals first, then to man.

In a third series of experiments we endeavor to ascertain the therapeutic rôle of the product under consideration. We inoculate an animal with the microbe in order to produce a certain disease; the disease having been produced, we administer the antiseptic. A second animal inoculated in the same

manner, but not subjected to the antiseptic dosage, serves for the control-test.

Then only, if the preceding experiments have given a favorable result, one will dare try a new product on man, giving it first in doses much smaller than those which experimentation on animals had indicated theoretically as the non-toxic dose for the human organism, and afterwards augmenting progressively or diminishing the dose, according to the effect produced.

These last series of experiments, practiced in the hospitals with all necessary prudence and every precaution needed in order to avoid any chance of mistake, enable us to class definitely the medicament or indicate its real value as an antiseptic, if it has any value.

The finding of the therapeutic power of a given antiseptic is what Bouchard calls the finding of its *antiseptic equivalent.* "Thus far," says Bouchard, "experimenters have sought in general to establish the dose which prevents the germination of this and that microbe in one thousand grammes of culture broth. This is the antiseptic equivalent, a dose much inferior to that which kills the microbe, but superior by one-half, at least, to the dose which only retards its germination, and which is itself a dose useful in therapeutics."

The *toxic equivalent*, says Bouchard, is that proportion of a fatal dose of the antiseptic which corresponds to one kilogramme of body-weight in the animal under experimentation (for this quantity varies from one species to another). The toxic equivalent in man is determined by the same rule, but varies not only according to the weight of the person but also according to age, to sex, to accustomance, to the dis-

position of the moment, or even to individual idiosyncrasies. The knowledge of the toxic equivalent should follow that of the antiseptic equivalent.

Between these two equivalents, or by their side, we place the *therapeutic equivalent*, which interests us most in practice. To obtain this equivalent, Bouchard injects the medicament directly into a vein; whatever may be the amount injected up to the precise moment when *the first physiological effects* (dilatation of the pupil in the case of atropine, narcosis in the case of alcohol) appear, is the therapeutic equivalent. The digestive and the hypodermatic channels, although preferable in therapeutics, cannot give such precise results as the method by intravenous injection, as the stomach and the subcutaneous tissues absorb the medicament too slowly.

A great many experimenters have published the results of their researches on the comparative value of antiseptics, but most of them give only the *antiseptic equivalent* of the medicaments studied by them. Tables of this kind have been published, notably by Jalan de la Croix in 1881, by Miquel in 1883, by Bouchard and Tapret. We shall borrow from these tables valuable indications in the course of this work, and shall note under each medicament its antiseptic equivalent.

An important discovery resulting from experiments made on animals and on man, is this: The mixture of several antiseptics is more antiseptic than each of its components taken separately; the toxic power of the mixture is not augmented proportionally to its antiseptic power (Bouchard and Lépine).

MODE OF EMPLOYMENT AND INDICATIONS.

The antiseptics being once known, it is proper to

examine in what manner they should be used, a pathological case being given of which the diagnosis is well established.

And first, if we know the microbe which causes the disease, it is evident that we should employ as far as possible the antiseptic which is specifically active against this microbe. Thus it is that mercury and its preparations are employed against the supposed microbe of syphilis, cinchona and the salts of quinine against the micro-organism of malaria. So, also, experience has shown that creasote is particularly active against the bacillus tuberculosis, and iodoform against the microbes of suppuration.

But when there is an association of several microbes, or when we know of no specific for such as are present, or when, even, the species of micro-organism is unknown to us and we know only that *some* microbe is the causal agent, we are not necessarily disarmed in the presence of the disease. We know that the microscopic organisms, whether they belong to the vegetal or to the animal kingdom, are all more or less sensitive to the action of compounds which we designate under the name of antiseptics. The pathogenic bacteria, which all belong to the same general family (Bacteriaceæ), are particularly susceptible to antiseptics, and all are more or less hindered in their development by the action of energetic medicaments like corrosive sublimate. Their development is also retarded by the salts of quinine, although the latter are considered as specific only in malaria. While there may be reason, in a particular case, to make a choice among the antiseptics, we should not, in more obscure cases, allow ourselves to be checkmated because there is no antiseptic specifically appropriate for the disease, but should supply those

whose general antiseptic action is well known to us, or some eclectic admixture similar to that of Dr. Lépine.*

We should also distinguish between a *local* and a *general* antisepsis, and according to the circumstances we should attempt the one or the other, or employ both at the same time. In all cases there will be a choice to make, certain medicaments being more appropriate to local, and certain to general antisepsis.

By local antisepsis we understand *topical* antisepsis, such as can easily be effected when we have to do with disease or lesion of the skin or of the mucous membranes which line parts easily accessible (mouth, throat, vagina, etc.). Here most energetic antiseptics are sometimes indicated—*e. g.*, corrosive sublimate and phenic acid, medicaments that can hardly be utilized internally on account of their toxic action. The antisepsis of closed cavities, as of the pleura after paracentesis, should also be considered as local antisepsis.

General antisepsis is applied internally, whether by the stomach or by the subcutaneous method. When we give quinine for malaria, or mercury for syphilis, we perform general antisepsis, and it is probable that salicylate of soda acts in the same way in

---

* ANTISEPTIC MIXTURE. (LÉPINE.)

	Grammes.
Corrosive sublimate	0.001
Phenic acid	0.10
Salicylic acid	0.10
Benzoic acid	0.05
Chloride of lime	0.05
Bromine	0.01
Hydrobromate of quinine	0.20
Chloroform	0.20
Distilled water	100.

acute rheumatism, whether this affection be microbic or not. The intravenous injections act much more rapidly than the hypodermatic, as Bouchard's laboratory experiments have shown; but this method is too dangerous for any but very exceptional cases of grave septic infection. *Per contra*, interstitial injections in the parenchyma of internal organs (as the lungs) have been made with success.

The antisepsis of the digestive tube takes a place between local and general antisepsis. In reality it is in most cases only a local antisepsis, and it is really this which we propose to effect when we give by mouth powdered charcoal, salicylate of bismuth, naphthol, etc. There is in these cases a demand for the exhibition of substances, such as those just mentioned, which are insoluble or nearly so in the gastric and intestinal juices; and very toxic compounds, such as phenic acid and corrosive sublimate, are to be employed in very feeble doses or not at all. Of the mercurial preparations, calomel and gray powder, as being relatively insoluble, are to be preferred.

PLAN AND DIVISION.

Most of the antiseptics actually in use being substances newly introduced into the materia medica, and consequently little known, it has seemed proper to commence by indicating their physical, chemical, and physiological properties before making known their therapeutic properties.

Part I will, then, be devoted to the study of antiseptics from a chemical, pharmaceutical, and physiological point of view; we shall indicate at the same time their antiseptic, therapeutic and toxic equivalents whenever these equivalents are known. We shall study separately the substances derived

from mineral or inorganic chemistry, and those furnished by organic chemistry, following the methodical order which agrees best with the properties of these substances.

Part II will be devoted to the clinical study of antiseptics. We shall examine separately each disease which demands antiseptic treatment. We shall give for these several diseases the therapeutic procedures and formulæ most in use, following the natural order of a treatise on internal pathology, and referring the reader to the First Part for every detail relative to the study of antiseptics considered in themselves.

Part III, much the shortest of the three, will be devoted to antiseptic hygiene, and more particularly to the hygiene of the sick.

PART I.

STUDY OF ANTISEPTICS FROM A CHEMICAL, PHARMACEUTICAL, AND PHYSIOLOGICAL POINT OF VIEW.

CHAPTER I.

ANTISEPTICS BORROWED FROM MINERAL OR INORGANIC CHEMISTRY.

Generalities and Classifications. — Experience has shown that the most energetic antiseptics, that is to say, the chemical mineral substances which most efficaciously arrest the development of bacteria in general, are compounds of the noble metals, and are but little alterable in the air, such as mercury, silver, gold, etc.

"When you give a general glance," says Dujardin-Beaumetz, "over the tables given by Miquel, you cannot fail to note the high rank in the scale of antisepsis which is occupied by the noble metals, such as mercury, platinum, silver, and gold. In a rank a little below we must place the common metals, such as copper, iron, etc. To the third rank belong the alkaline earthy metals, and a fourth place must be assigned to the alkaline metals."*

Dujardin-Beaumetz, "New Medications," 2d Am. ed. vol. i, p. 113.

When we come to the metalloids, we find that the greater or less of affinity which these bodies have for hydrogen seems to be an index of their antiseptic power. Chlorine, bromine, and iodine, which combine in equal volume with hydrogen, are energetic antiseptics; and chlorine, which unites directly with hydrogen under the influence of diffuse light, is more powerful than the two others, but its toxic power is proportional to its antiseptic power. These metalloids are called *halogen radicals*.

As for the salts, it seems that their antiseptic power, like their toxicity, is in inverse ratio to their abundance in nature, and, more particularly, in the tissues of living beings. The salts of potassium, of sodium, iron, etc., which are active components of the tissues of man as of the animals and plants which serve for his food, and which by a natural consequence serve also for the food of the pathogenic microbes, are not toxic, while the salts of silver, of mercury, of copper, of lead, etc., which can hardly be said to be native to the organism, are toxic and antiseptic.

Another datum springing from the researches made on the microbicide power of mineral substances, is the great number of acids which are antiseptic, while the bases (ammonia, soda, potash, etc.) are but feebly antiseptic, notwithstanding the large doses employed.

This fact finds explanation in what we know of the way in which bacteria live. The cultures of the

laboratory show that these microscopic organisms can only thrive in nutritive media which are neutral or slightly alkaline, as are generally the culture broths. Only a very small number of microbes can develop in an acid medium.

"In a general way it may be said that acids added to culture broths are noxious to bacteria; yet the organic acids (tartaric, lactic, citric, acetic) oppose their reproduction less than the mineral acids. *The bases do not in general hinder their vegetation.* The fungi whose structure is more complex are, on the contrary, favored in their growth by the presence of acids, as is observed in fermentations."* Thus the *Saccharomyces albicans* or thrush fungus, which is not a true microbe or bacterium, but a fungus of the group of ferments, only develops in an acid medium. But most of the pathogenic bacteria will grow only in a neutral or alkaline medium; the microbes of diphtheria and Asiatic cholera belong particularly to this category.

If we examine particularly the different salts experimented with as antiseptics, we see that their efficacy depends both on the nature of the metal whose oxide or hydrate serves for their base, and on that of the body (generally a metalloid) which plays the rôle of acid in their composition. Hence, although the salts of potassium are in general very feeble anti-

---

* Cornil and Babes, "Les Bacteries," 3d ed., page 39.

septics (we have given the reason why), compared especially with the salts of mercury or of silver formed with the same acids, still bromide of potassium is somewhat antiseptic by virtue of the bromine it contains—for in the organism, which contains chlorides, the bromine is partially or wholly liberated from the potassium. So also salts rich in oxygen, such as permanganate of potassium (K_2MnO_4), potassium bichromate ($K_2Cr_2O_7$) and chlorate ($KClO_3$), are all more or less antiseptic by reason of the large proportion of oxygen which they contain, and which they yield up readily to the organic matters with which they are put in contact. The chlorate acts, moreover, by the chlorine set free in this reaction. These are chemical properties which must be borne in mind when it is a question of explaining the action of an antiseptic.

It will be seen that the properties of these medicaments are, to a certain point, indicated by their chemical composition. It is, then, natural to study them in the order adopted by chemists, and this is the plan which we shall follow.

METALLOIDS.

Chemists divide the metalloids, according to their affinity for hydrogen, into four natural groups, which we shall study in the following order, confining ourselves to the bodies which interest us from the point of view of antiseptic medicine:

Group 1.—Chlorine, Bromine, Iodine, Fluorine.

Group 2.—Oxygen, Sulphur, Selenium, Tellurium.

Group 3.—Nitrogen, Phosphorus, Arsenic, Antimony, Bismuth.

Group 4.—Boron, Carbon, Silicum, Stannum.

HYDROGEN; WATER.

Hydrogen, which, by its characters, forms in itself a family apart, only interests us here as being a component of water (H_2O), which may be considered, especially from a hygienic point of view, as the simplest and most general of the antiseptics employed externally. It is also the solvent and vehicle of a great number of antiseptics used internally and externally. But bacteriological researches have shown how necessary it is that the water employed, not only as a beverage, but for the needs of cleanliness, and above all for medical use, should be absolutely free from all microbes.

The greater number of pathogenic microbes live very well in water, and the contagion of typhoid fever by drinking-water is a fact considered as proved. It is probable that a very great number of other pathogenic microbes may be introduced into the organism in the same way. We shall not insist upon this point, but we shall indicate how it is possible to procure water free from microbes.

Aseptic Water.—Heat carried to the boiling-point, and filtration, are the principal means employed for

purifying water to render it aseptic. The water is made to boil for about a quarter of an hour, and is then turned into a vessel communicating with a Chamberland filter; after filtering, it is collected in receptacles, which may be of glass, in the shape of little barrels placed upright, with a capacity of six to ten quarts each, and provided with a tap at the lower part. Boiling is not indispensable, the filtration through the Chamberland filter being sufficient. All pharmaceutical solutions should be prepared with water thus purified.

Great use has been made of water in surgery in the treatment of wounds. Recall the *continued irrigation*, in use twenty-five years ago, which acted at once as a refrigerant and as an antiseptic, carrying away the microbes with the products of suppuration, and continually *washing* the wound. In 1870 we saw applied in the field-hospital of the *Comédie Française*, during the siege of Paris, the *tepid bath* treatment as the sole treatment of gun-shot wounds, and this practice gave very satisfactory results. Some surgeons still recommend irrigation of amputated stumps and recent wounds (Reclus). But this method is generally abandoned to-day for the antiseptic dressings properly so called—closed dressings, which are at once more sure and more rapid. Irrigations and pulverizations of antiseptic solutions are very much in use.

Ice, like the water from which it is derived, con-

tains microbes. Ice used in therapeutics should be strictly limited to that which comes from water filtered through the Chamberland filter.

CHLORINE.

A metalloid, gaseous at the ordinary temperature, of a greenish-yellow color, suffocating odor, caustic taste, unfit for respiration, and deleterious. One quart of water dissolves two quarts of chlorine, at the temperature of 156° to 20° C. (312° to 68° F.). It is in this form that it is employed in medicine.

Gaseous chlorine, according to Jalan de la Croix, is one of the most powerful germicides: it ranks, under this head, immediately after corrosive sublimate; one gramme of gaseous chlorine dissolved in 30 litres of water arrests the development of bacteria in a culture broth.

Notwithstanding this fact, chlorine cannot be employed internally, on account of its irritant action. Breathed in the gaseous state, it provokes cough, suffocation, and spitting of blood. It is difficult to understand why it was formerly recommended for diseases of the bronchi and even for phthisis.

On the other hand, chlorine is one of the best antiseptics that can be employed to disinfect garments and buildings. We shall return to this subject in treating of *antiseptic hygiene.*

Hypochlorite of lime ($CaCl_2+6H_2O$), or calcium chloride, which owes its properties to both oxygen

and chlorine, does not so affect microbes unless in treble the quantity (3 grammes to 30 litres). It is a white powder, with strong odor of chlorine, eagerly absorbs moisture, but is only partially soluble in water. The solution of the Codex (liquid calcium chloride) is $\frac{1}{45}$. It is rarely used except externally. According to Cornil and Babes, a 5-per-cent. solution of this salt requires ten days to kill bacteria. Gaseous chlorine must, then, be preferred to it, particularly for the disinfection of apartments.

Chlorate of potassium ($KClO_3$) is a white salt soluble in 17 parts of water at 15° C., and in 30 of glycerin, insoluble in alcohol and ether. It acts as an oxidizing agent upon organic matters on account of the three equivalents of oxygen which it contains, which also give it a great tendency to unite with hydrogen. It is employed in the treatment of stomatites: it is eliminated in part by the salivary glands. Its toxic equivalent (the fatal dose for one kilogramme weight) is 1.6 centigrammes of a $\frac{1}{100}$ solution, while its antiseptic equivalent is insignificant. It acts only as a disinfectant.

Chlorate of sodium, soluble in 3 parts of water, appears to have the same properties as the above, but its toxic equivalent is much more feeble. This is evident when the salts of sodium are compared to the salts of potassium, and is to be accounted for by the fact that sodium is a much more common constituent than potassium of animal organisms; the contrary is the rule in plants.

Hydrochloric acid (HCl) is the product of the direct union of chlorine and hydrogen, which takes place very readily, under the influence of diffused light, when a volume of chlorine and hydrogen are brought together. It is a colorless gas, of strong odor, pungent, irrespirable, and has great avidity for water, as is shown by the fumes which it produces in the air when it combines with vapor of water.

Water dissolves, at 20° C., 464 times its own volume of this gas. It is this saturated solution which constitutes the hydrochloric acid employed as a reagent in laboratories. The acid of commerce contains only 36 to 37 per cent. of the gas. It produces eschars upon the skin and mucous membranes.

This acid is *strongly* antiseptic (Miquel) in the dose of 2 to 3 grammes; the same may be said of the other mineral acids, sulphuric, nitric, and phosphoric.

The solution (2 to 4 grammes per litre of water) is used for gargles and for a refrigerant beverage.

Several drops of this acid added to solutions of corrosive sublimate or phenic acid increase their antiseptic properties (Laplace).

Fumigations of hydrochloric acid have been recommended, since the end of the last century, as disinfectants, by Guyton-de-Morveau.

The chlorides will be studied with their metals, and the organic compounds of chlorine (chloral, chloroform) in the following chapter.

BROMINE.

Bromine is a reddish-brown liquid, giving off red fumes when exposed to the air, the disagreeable odor of which resembles at once that of both iodine and chlorine. It is but slightly soluble in water (3 per cent.), very soluble in alcohol and ether.

It is an irritant caustic of almost instantaneous action; but as, on the one hand, its antiseptic equivalent is superior to that of iodine, and, on the other hand, it is easier to manage than chlorine, it should be preferred to those two bodies, whose general properties it possesses; care must be taken not to use it except in very dilute doses.

Its antiseptic equivalent places it in the sixth rank after corrosive sublimate (Jalan de la Croix). A solution of $\frac{1}{6308}$ arrests the development of bacteria. It also prevents, in very weak doses, the action of soluble ferments (emulsin, ptyalin, diastase, etc.), and it might be employed to advantage against the poisons of microbic origin which have the constitution of diastases.

These antiseptic properties might suffice to restore to popularity a medicament too much neglected to-day. Ozanam showed in 1869 its utility in dissolving diphtheritic false-membranes (in solutions of $\frac{1}{500}$ or $\frac{1}{1000}$). He also employed fumigations of bromine water. More recently it has been used together with bromide of potassium, in equal parts

($\frac{1}{200}$ or $\frac{1}{400}$ of each in watery solution), for swabbings and inhalations (Hiller).

Bromides.—The bromides of *potassium*, *sodium*, *strontium*, have been used as less toxic succedanea of bromine. But these salts are much less antiseptic than the metalloid from which they are derived, and act only in strong doses (Miquel ranks them among the *very feebly* antiseptic substances, while bromine is very strongly so).

Dr. Peyraud (of Libourne) has used with success insufflations of pulverized bromide of potassium for diphtheritic angina.

Bromal, *bromoform*, and *bromhydrate of quinine* are organic compounds of bromine which will be studied in their proper places.

IODINE.

Iodine is solid at ordinary temperatures, fusible at 110° C., and but slightly soluble in water ($\frac{1}{7000}$ at 10° C.), but it is soluble in alcohol, chloroform, benzine, carbon bisulphide, ether, fatty bodies, glycerin, and vaselin. It combines with hydrogen only at red heat, but decomposes hydrogen sulphide by taking away its hydrogen. It is an irritating agent, caustic, colors the skin yellow, and produces local inflammations in contact with the mucous membranes.

The tincture of iodine of the Codex consists of one part iodine to twelve of alcohol. It is well to remember that the tinctures of the foreign pharma-

copœias are often much more concentrated, and consequently more active. The French tincture of iodine itself varies very greatly in this respect when it has been prepared for a long while and kept in badly stoppered flasks. The addition of a certain quantity of iodide of potassium permits dilution of the tincture with water without precipitation of the iodine.

The action of iodine as a disinfectant was indicated long ago by Boinet (1840). Later (1863), O. Réveil showed that it would neutralize the action of viruses and venoms (in solutions of 5 per 100); Wernitz (1880), that it has the same effect on soluble ferments (in solutions varying from $\frac{1}{1000}$ to $\frac{1}{24000}$). According to Jalan de la Croix, a solution of $\frac{1}{410}$ sterilizes all the spores of bacteria. Royer and Davaine have shown the power of the tincture of iodine on the virus of glanders and on that of charbon (solution of $\frac{1}{150000}$).

Iodine may be used internally in doses of one to five centigrammes per day. As a gargle or collutorium, a mixture of tincture of iodine and glycerin with a little iodide of potassium is often used. In empyema and hydrocele, after having withdrawn the liquid by tapping, the surgeon injects an aqueous solution of iodine and iodide of potassium.

The *iodides* of potassium, of sodium, of strontium, etc., have a very weak antiseptic power, while the biniodide of mercury, the iodide of silver, and the iodide

of cadmium are very strongly antiseptic (Miquel). The first two occupy even the first and second place in the table given by Miquel. They are antiseptic in quantities respectively of 25 and 30 milligrammes to a litre of beef bouillon exposed to the contagion of microbes of the air, while bichloride of mercury is antiseptic only in quantities of 70 milligrammes to the litre. The iodide of sulphur has been used by Galtier for chronic glanders.

The eminently antiseptic properties of chlorine, bromine, iodine (mono-atomic metalloids), and of compounds formed by their union with the noble metals or the earthy-alkaline metals (cadmium belongs to the same group as zinc), may be explained by their chemical properties. It is known that the chlorides are powerful oxidizers of organic matters—a property which they owe to their great affinity for hydrogen, which always enters into the composition of these latter. The iodides and bromides have analogous properties: *in presence of an oxidizable body they split up, and act at once by the metalloid and by the metal,* set at liberty in the nascent state, which enter into their composition; it is this which explains why the iodides of mercury, silver, and cadmium are much more antiseptic than those of potassium, sodium, etc. The first are easily decomposed in the organism, while the last are found* unaltered in the urine.

---

*It is well to remember that the alkaline chlorides normally exist in the organism and in our food (muscular juice, etc.).

However this may be, when use is made of these very active bodies it must always be remembered that their action is exerted on the cells of our organs as well as on microbes, and that consequently they ought not to be used except in very weak doses and in a very dilute form.

FLUORINE; HYDROFLUORIC ACID.

Fluorine is a metalloid belonging to the same group as the preceding, and presenting similar properties, but difficult to isolate, and known only by its salts—which resemble the chlorides, and from which it has been possible to isolate the acid.

Hydrofluoric acid (obtained from *fluor spar* or *fluoride of calcium*) is a colorless liquid, mobile, boils at 15° C.; the fumes are very corrosive, producing blisters on the skin followed by very painful wounds. It is used in the arts only, in very dilute solutions.

The experiments conducted by MM. Dujardin-Beaumetz, Hayem, Thompson, Chevy, have proved, contrarily to the affirmations of M. Grancher, that hydrofluoric acid is a powerful antiseptic, meriting a place near biniodide of mercury. In the proportion of about 1:20000 it will kill the bacillus of tuberculosis (H. Martin).

Hydrofluoric acid, mixed with atmospheric air (1 to 200), has been recommended by M. Seiler as an inhalant in pulmonary tuberculosis. It acts by arresting the development of bacilli (Trudeau).

OXYGEN; OZONE; AIR.

With *oxygen* we take up the second group of metalloids, which includes sulphur, selenium, and tellurium—bodies not mono-atomic like the preceding, but diatomic with respect to hydrogen. They do not combine with it volume by volume, like chlorine and iodine; but one volume of oxygen, for instance, combines with two volumes of hydrogen, and the whole is condensed to two volumes instead of three. But this combination is effected with some difficulty, for two volumes of hydrogen and one of oxygen brought together will not combine to make water except under the influence of the electric spark or an elevated temperature (by the setting on fire of the hydrogen). The metalloids of this group have, then, much less affinity than the preceding for hydrogen, which explains their feebler antiseptic power.

Oxygen, the active component of atmospheric air, is an antiseptic of great importance.

Pasteur has shown that microbes, notably that of fowl cholera, lose their virulence under the influence of the oxygen of the air; cultures dating from fifteen days, one month, two months, eight months, ten months, lose progressively their toxic power. Koch admits also that the action of the air and the desiccation of the germs effect, at the end of a certain time, the natural extinction of an epidemic. Finally, the experiments of P. Bert and M. Regnaud have shown that oxygen kills bacteria, but only at high pressure.

The therapeutic applications based on these notions are numerous. The sojourn of the tuberculous in the country or in elevated localities where the air is renewed often; the treatment by *open windows* night and day, in all seasons (Debove); aërotherapy by compressed air charged with antiseptic substances (creasote, guaiacol, terpinol, etc.); all these therapeutic processes have for their end to apply the action, at once antiseptic and stimulant, of air—that is to say, of oxygen.

The manufacture of oxygen in portable apparatus, for medical and other purposes, is to-day assured, and the profession can easily be provided with large enough quantities for all therapeutic uses. It is kept in store in compressed form, and when the physician desires to administer it it is decompressed in order to be mixed with atmospheric air and the various antiseptic vapors. Oxygen is too excitant a remedy to be used pure. Compressed air—that is, mitigated oxygen — charged with certain medicinal vapors, is set free in hermetically closed rooms or bell-shaped receptacles. Here the patients are made to stay from one to two hours or more, while the medical attendant slowly compresses or decompresses the gaseous mixture which they breathe. This *aërotherapy* is employed in tuberculosis, whooping-cough, chronic bronchitis, etc.

Oxygenized water or *binoxide of hydrogen* (H_2O_2) is a definite chemical compound which must not be

confounded with the oxygenized water ordinarily sold in syphons; the latter is nothing but oxygen mixed with ordinary water at high pressure, like carbonic acid in Seltzer water. Both, however, may be used for the same purposes. The chemical oxygenized water (H_2O_2) is a ten-volume solution, diluted with the same quantity of pure water to render it non-irritant. According to the researches of M. Desmoulins,* this is but a middling antiseptic. In reality it acts primarily as a disinfectant in oxidizing organic matters by the setting free of the oxygen which it contains.

Ozone is an allotropic modification of gaseous oxygen, obtained under the influence of the electric spark. Its properties closely resemble those of oxygenized water; but instead of being administered by mouth, as is most convenient with oxygenized water, it is adapted to direct application to the lungs by inhalation. It is generally admitted that ozone is condensed oxygen (O_3), but it is hardly known except in the form of ozonized oxygen—that is, mixed with an excess of oxygen.

Ozone possesses the property of oxidizing, at the ordinary temperature, bodies upon which oxygen itself has no effect; this it is which has given ozone its reputation as an antiseptic. Apparatus specially designed to produce ozone have recently been constructed, for the purpose of enabling patients to

* Thèse de Lyon (1887).

breathe ozonized air or oxygen, which acts at once as eusthenic and antiseptic.

SULPHUR.

Sulphur is one of the most common metalloids in nature, and is to be found both pure and in combination. In medicine it is principally used under the form of *flowers of sulphur*, freed from impurities, and employed as a pomade in diseases of the skin. It destroys the lower organisms (fungi, parasites, acari, etc.). It is rarely used internally as an antiseptic.

Hydrogen sulphide, or sulphuretted hydrogen (H_2S), also exists in nature, notably in sulphur waters. It is produced by the putrefaction of organic matters, and traces of it are found in atmospheric air. It is the major constituent of the toxic gases of cesspools and privies. It is easily absorbed, not only by the lungs, but also by the skin and mucous membranes. The sulphur waters have been recommended in the treatment of tuberculosis and of chronic bronchitis.

The alkaline sulphides are classed by Miquel among the substances *strongly* antiseptic.

Calcium sulphide has been used internally with success in the treatment of diphtheritic anginas (one to ten centigrammes and more, in fractional doses). In the stomach it is probably decomposed, setting free hydrogen sulphide, for the breath of patients to whom it is administered smells strongly of *rotten eggs;*

and it is the sulphuretted hydrogen thus set free which gives thiis salt its antiseptic properties. It is used externally as an antipsoric.

Sulphurous acid (SO_2) is a gas produced by the combustion of sulphur in the air. It is an energetic antiseptic—Jalan de la Croix gives it the fourth place, after corrosive sublimate and chlorine—but it destroys only the bacteria which are on the surface of objects; it has no effect when the parasites are not exposed. Diffused through the air of a room in the proportion of 1 per 100, this gas will disinfect the walls, but the spores are not destroyed (Cornil and Babes).

Sulphuric acid (SO_3), which is found in commerce only in the form of Nordhausen's sulphuric acid ($SO_3 + H_2SO_4$), or *oil of vitriol*, shares the properties of sulphurous acid, from which it is derived. Miquel classes it among the *strongly* antiseptic bodies. But its avidity for water, which is probably one of the principal causes of its germicidal action, makes it very difficult to manage. It is very caustic, taking away from organic substances both oxygen and hydrogen in the proportions necessary to form water; it disorganizes and ulcerates the skin and mucous membranes. It must only be used internally in a state of great dilution.

Nearly all the *sulphates* have marked antiseptic properties. Copper sulphate occupies the first place; its equivalent is 90 centigrammes per litre, an equiva-

lent superior even to that of its acid, and Miquel classes it among the substances *very strongly* antiseptic. Then comes nickel sulphate, strongly antiseptic (equivalent, 2.50 grammes). The sulphates of strychnine, of iron (moderately antiseptic), and of ammonia, and the hyposulphite of soda (very weakly antiseptic) act only in very much stronger doses.

Selenium and Tellurium, as well as their compounds, have no use in medicine.

NITROGEN.

Nitrogen, phosphorus, arsenic, antimony, and bismuth form a third group of metalloids possessing similar properties: all are triatomic, combining with three atoms of hydrogen or of chlorine.

Nitrogen gas mixed with oxygen in atmospheric air appears to serve only as a diluent. In its purity it is irrespirable, but this is simply because of the lack of oxygen, for it is not toxic. Attempts have been made of late to utilize it in therapeutics, although its physiological action is not well known. Nor is its action on pathogenic microbes any better known:* on the aërobic it acts by deprivation or diminution of oxygen; it has no effect upon the anaërobic. It is well to remember that nitrogen exists in a state of combination more or less complex in most of the tissues and liquids of the organism.

* We shall see later that the presence of nitrogen in an organic combination *lowers* (other things being equal) its antiseptic power.

Nitrogen has been used for inhalations in febrile diesases to diminish the organic exchanges and consequently the temperature (Valenzuela, of Madrid). Nitrogenized waters, natural or artificial, have been administered in sprays for the same end, in Germany and Spain. No definite results have been obtained.

Nitric acid (HNO_3) is liquid, giving off white fumes in the air. It is a very powerful oxidizing agent and a caustic which decomposes organic matters, coloring them yellow. As an antiseptic it has the same equivalent as the other acids, and does not offer any advantage over sulphuric acid. Like the latter, it must only be employed in very dilute form internally, unless the physician desires to avail himself of its local caustic action, as in endometritis, where the indication is to destroy a diseased mucosa.

The *nitrates* used in medicine are, first, nitrate of silver, which may be considered as one of the most powerful antiseptics known (it occupies the fifth place in the table of Miquel; its antiseptic equivalent is 0.08 gramme, being nearly equal to that of bichloride of mercury). In contact with organic matters, silver nitrate is decomposed into metallic silver, nitric acid, and oxygen, *i. e.*, three more or less antiseptic bodies; this it is which explains its powerful action. But this action can hardly be utilized except externally; internally it is a violent poison even in small doses (the physician should never exceed doses of one to five centigrammes).—Acid nitrate of mercury is employed

as a caustic externally.—Bismuth nitrate owes its properties to the metalloid from which it is formed, and will be discussed further on.—Potassium nitrate (or nitre), and the other alkaline nitrates, appear to be without antiseptic properties.

Gaseous ammonia (NH_3) is classed by Miquel among the substances strongly antiseptic (equivalent, 1.40 grammes).

PHOSPHORUS.

Phosphorus, as is well known, exists in two allotropic states: the white, or ordinary, and the red phosphorus. The latter is not toxic, but the first is a violent poison. This essential difference is due to the ready solubility and oxidation of the white phosphorus as compared with the red. Phosphorus, in the metalloid state, has not been used as an antiseptic. As for *phosphoric acid*, it has the same general properties as the other acids, but is little used. Phosphorus exists in the organism in the state of alkaline phosphates.

The *phosphate of copper* is the only phosphate that has been used as an antiseptic in tuberculosis (Luton, of Rheims).

The phosphates and hypophosphites of calcium act only as eusthenics (tonics and reconstituents).

ARSENIC.

Arsenic and its salts have properties which resemble those of phosphorus. When arsenic is em-

ployed internally, as in intermittent fevers, it is probable that it acts as a eusthenic (by modifying the circulation), and not as an antiseptic after the manner of the salts of quinine. Warrikoff, of Dorpat (1883), has noted that arsenious acid does not destroy bacteria. Yet Miquel ranks arsenious acid (antiseptic equivalent, 6 grammes [!]) among the substances "moderately antiseptic."* In this dose arsenious acid would be a violent poison for man, since doses of ten *milligrammes* per day cannot be exceeded without danger.

ANTIMONY.

From a chemical point of view, antimony much resembles arsenic. This metalloid, which had such a great reputation in antiquity, in the Middle Ages, and even in the first half of this century, is to-day nearly abandoned. *Tartar emetic* (double tartrate of antimony and potassium) is used now only as an emetic or emeto-cathartic. This is not the place to speak of the "contra-stimulant" or antiphlogistic action of this salt. It does not appear to have microbicide properties, while its action upon the organism is very energetic and ought to be carefully watched. The same is also true of *kermes* (a mixture of oxide and sulphide of antimony) and of *white oxide* of antimony.

BISMUTH.

Bismuth, although belonging to the same group

* It has been used in embalming.

as the preceding, differs in several points, and forms a little group by itself. Its combinations with oxygen ally it closely to the metals. Its salts have very different properties, and several are actually much used in antiseptic therapeutics.

Bismuth was employed formerly only in the form of the *nitrate* or *subnitrate*, which is very slightly toxic, being insoluble in water and very slightly soluble in the stomach, while the soluble salts (citrates, tartrates) are toxic and produce tetanic paroxysms (contractures, arrest of respiration and of the heart). The subnitrate, resisting solution in the alimentary canal, exerts a purely physical action as an absorbent of liquids and gases. It acts in the same manner upon superficial wounds. It is, therefore, only an indirect antiseptic.

The salicylate of bismuth will be studied with the other compounds belonging to organic chemistry. Note, for the present, that it is insoluble, or slightly soluble, like the nitrate.

BORON.

Boron, carbon, silicium, and stannum form the last group of triatomic or tetratomic metalloids. Stannum, by its characters, forms the transition from metalloids to metals.

Boron is found in nature in the state of *boric acid* or of *borax*, notably in the lakes of Tuscany and in a great number of mineral springs. Boric acid and

borax have both been used for many years in medicine.

Boric acid is solid, crystallizable in transparent colorless plates, soluble in cold water (1 to 25), much more soluble in warm water; soluble in five parts of glycerin and in sixteen parts of alcohol at 90° C. It is but slightly toxic—25 grammes was on one occasion swallowed by a sick person without poisonous effects.

The antiseptic power of boric acid is really extremely weak; Miquel ranks it among the substances *moderately* antiseptic (equivalent, 7.50 grammes); but its therapeutic value is greatly enhanced by its extreme innocuousness. It is much used, either alone or associated with other more powerful antiseptics.

Boric acid prevents fermentation and putrefactions; it retards the development of bacteria without killing them. In the form of powder it is more active than in solution, though a saturated solution of $\frac{4}{100}$ is sufficient to arrest the harmful action of pathogenic microbes.

To obtain concentrated solutions of boric acid (solutions exceeding 4 per cent.), magnesia or the carbonate of magnesia is added. M. Puaux indicates the following formula:

Boric acid	100
Magnesium carbonate	14
Water	1000

Mix and gently warm.

This solution, which is of specific gravity 1.044, of acid reaction, is stable, and contains 100 grammes of boric acid to the litre, *i. e.*, is more than double the strength of the ordinary solution.

It is possible to prepare a solution of even greater strength—of 20 per cent.—and of a specific gravity equaling 1.088, by means of the following combination:

Boric acid	200
Magnesium carbonate	35
Water	1000

But a still better result may be obtained by using the tetraborate of sodium recently introduced into therapeutics by Jaenicke. This salt dissolves in cold water in the proportion of 16 per 100, and in warm water in almost any proportion (50 and 60 per 100).

Borax, or *borate of sodium*, is soluble in twenty-two parts of water, two of glycerin, and is insoluble in alcohol. Its antiputrid properties have long been known (Jacquez, 1856). Dumas (in 1872) showed that solutions of this salt will arrest alcoholic and diastatic fermentations, etc., and the digestion of fibrin by pepsin.

Borax is a weaker antiseptic than boric acid. Miquel classes it among the substances *weakly* antiseptic, and gives it an equivalent of 70 grammes, which indicates that it is four or five times less antiseptic than its acid. It renders the germs torpid, but does not destroy them, and they resume their activity when they are again in a favorable medium.

CARBON AND CARBONIC ACID.

Carbon is used in therapeutics in the form of charcoal only. A great number of bodies (phenols, etc.) are extracted from coal or fossilized carbon; and their study, like that of the greater number of carbon compounds, belongs to organic chemistry.

Carbonic acid gas, which is always present in atmospheric air, as a product of animal respiration, does not accumulate there, owing to plants which decompose it, fixing the carbon in their tissues and setting free the oxygen in the air. This gas is irrespirable, and, in proportions of 10 or 20 per cent., renders a confined atmosphere deleterious for man and animals.

Attempts have been made to utilize carbonic acid in therapeutics, and it has even been tried in pulmonary tuberculosis! None of the well-known physiological effects of this gas appear to belong to the domain of antisepsis.—Remember that certain anaërobic microbes (butyric and septic vibrios of Pasteur) live in pure carbonic acid, in nitrogen or hydrogen, and are killed by oxygen.

Liborius has drawn up a table of the principal bacteria in the order of their greater or less affinity for oxygen;* but there are many which live as well without air as in the air; such are those of pneumonia,

---

* Cornil and Babes, "Les Bactéries," 3d edit., vol. i, p. 131.

etc. Application has not yet been made of these data to the therapeutics of microbic diseases; but what we thus far know does not seem favorable to the employment of carbonic acid as an antiseptic.

Carbon protoxide must not be confounded with carbonic acid; it is much more deleterious than the latter, for it combines with the hæmoglobin of the blood-corpuscles, destroying it and rendering it unfit for hæmatosis. This toxic gas is formed when carbon is burned at a high temperature in the presence of a quantity of oxygen insufficient to transform it into carbonic acid, or when the latter is decomposed by bodies capable of taking away its oxygen. A dog will die in air containing $\frac{1}{250}$ of its volume of this gas, and a man would be poisoned, especially during sleep, by a much smaller dose. It has been used as a local anæsthetic.

The sulphide of carbon will be studied with the organic compounds of carbon.

Silicium and Stannum, and also their salts, are without use in antiseptic therapeutics.

METALS.

The metals are monoatomic or diatomic, with the exception of gold, which is at once mono- and tri-atomic, and platinum, which is di- and tetra-atomic. They are divided into groups in the following manner:

First group.—Potassium, Sodium, Rubidium, Lithium.

Second group.—Ammonium.

Third group.—Silver (always monoatomic).

The following are diatomic:

Fourth group.—Barium, Strontium, Calcium.

Fifth group.—Plumbum (lead).

Sixth group.—Magnesium, Zinc, Cadmium.

Seventh group.—Copper, Mercury.

Eighth group.—Iron, Chromium, Manganese, Nickel, Cobalt.

Ninth group.—Aluminium.

Tenth group.—Gold (mono- and tri-atomic).

Eleventh group.—Platinum, Osmium (di- and tetra-atomic).

This table shows that the atomicity has not a capital importance from an antiseptic point of view, at least when metals and their inorganic salts are concerned, since powerful monoatomic antiseptics exist, as silver; others are diatomic, as mercury; others still, triatomic, as gold; or tetratomic, as platinum.

POTASSIUM; SODIUM.

These two metals exist in the organism in the form of potash, soda, and combinations with chlorine. The salts of soda predominate; but, as our food (meat, bread, etc.) contains salts of potassium in greatest quantity, we need additions of common salt (sodium chloride) to preserve the physiological balance.

The salts of potassium are, moreover, toxic in doses in which the salts of sodium produce no harmful effects or are merely purgative. Thus, 8 grammes of potassium sulphate produce the same purgative effect as 30 grammes of sodium sulphate; in the latter dose, potassium sulphate would be toxic. According to Miquel, potassium iodide, potassium bromide, and sodium chloride have but a very weak action on bacteria, as the enormous doses which must be employed indicate (antiseptic equivalents, 140, 240, and 165 grammes).

Potassium cyanide, which is strongly toxic and strongly antiseptic, owes its properties to hydrocyanic acid. Likewise the *bichromate* ($K_2Cr_2O_7$), the *permanganate* ($K.2MnO_4$) and the *chlorate* of potassium ($KClO_3$), which are more or less *strongly* antiseptic, owe this property, as has already been said, to the large proportion of oxygen which they contain and which they easily yield to organic matters.

Potash and soda are caustic; the first enters into the composition of *Vienna paste*. The sulphides of potassium and sodium act in the same manner as hydrogen sulphide, and are toxic in larger doses than a few centigrammes. The base, however, has no effect on their antiseptic action.

These considerations are sufficient to show that the salts of potassium and of sodium are, with the exception of the bichromate and the permanganate (oxidizing agents acting primarily as disinfectants), poor antiseptics.

Lithium and Rubidium furnish no antiseptic compound.

AMMONIUM—AMMONIA.

Ammonia gas (NH_3) is considered by chemists as the hydrate of a metal (NH_4) designated by the name of *ammonium*. The ammoniacal salts have indeed much resemblance to those of the alkaline metals, and we may at once conclude that they are feebly antiseptic. This is what direct experience shows.

The gas ammonia, which is a very violent irritant poison to the organism, is of itself strongly antiseptic. But in the form of solution (liquor ammoniæ), this base acts as a caustic and can hardly be used except to cauterize venomous wounds.

Ammonium chloride (sal ammoniac) is only feebly antiseptic, in the enormous dose of 115 grammes.

SILVER (ARGENTUM).

Silver is the only monoatomic metal which is a good antiseptic. It acts upon microbes, even in the metallic state, despite its relative unalterability. It has been stated that the lower vegetable organisms cannot grow in a silver vessel (Cornil and Babes). The silver salts are toxic when given internally in larger doses than ten to twenty centigrammes.

Iodide of silver is, as has already been said, a powerful antiseptic, coming immediately after the biniodide of mercury in the table of Miquel. Its anti-

septic equivalent is 30 centigrammes, but it is not much used—the biniodide of mercury being generally preferred.

Nitrate of silver is the sole compound of this metal which is used in medicine. It is a powerful antiseptic, occupying the fifth place in the list of Miquel (equivalent, 8 decigrammes).

This crystallized salt is soluble in water, glycerin, and alcohol. It is chiefly used externally, notably in the treatment of ophthalmias of microbe origin. The relative innocuousness of this remedy when used, and the ease with which its action may be limited by neutralizing all excess of the salt with a solution of sodium chloride (which produces an insoluble chloride of silver), renders it of great practical utility, especially when a rapid action (which may be repeated as often as necessary) is desired. Nitrate of silver may be melted and run into moulds; in the form of a pencil or crayon it is used as a caustic.

CALCIUM; BARIUM; STRONTIUM.

These three diatomic metals, closely related by the nature of their salts, present great differences in respect to their action on the organism. The salts of barium are very poisonous, while those of calcium and of strontium are not more so than the salts of the alkaline metals.

We know that the salts of calcium are present in the organism (muscles, blood, bones) and in the

greater part of our foods (meat, bread, etc.). It may be concluded that these salts are not antiseptic, and experience indeed shows that *calcium chloride*, in spite of the presence of chlorine, is a *weak* antiseptic (equivalent, 40 grammes, according to Miquel).

Lime-water, which is employed in medicine, is alkaline, and, according to what we know of the action of alkalies, cannot be considered as an antiseptic. It acts only upon the lower fungi which, like the thrush plant (*Oidium albicans*), thrive in an acid medium.

We have already spoken of calcium sulphide, which acts, as do all the sulphides, by setting free hydrogen sulphide.

The *acid iodate of calcium* has been found to be an energetic antiseptic, not surpassed by anything but corrosive sublimate; it is at the same time harmless when taken internally (Klein).

The *iodide* and the *bromide of strontium* have been used, during the past few years, for the same purposes as the corresponding salts of potassium.

According to what we know of the toxic action of the salts of barium, one might be surprised to see *chloride of barium* classed among the *weak* antiseptics (Miquel) with an equivalent inferior even to the chloride or hypochlorite of calcium. The researches of M. Charles Richet confirm this surmise. Baryta is, however, caustic, but does not offer any advantage over potash. It has been known for a long time that the salts of barium arrest the germination

of seeds (De Candolle). It would appear that they do not act except in very large doses upon the lower vegetal organisms of the group of bacteria. The iodide and the chloride of barium have been employed externally with success, as anti-scrofulous medicaments.

To sum up, the salts of barium are believed to act upon the organism as paralyzers of the heart, and muscular stimulants, but not as antiseptics (Boehm).

LEAD.

The salts of lead are toxic to man, and seem to have been studied but little from the point of view of their action upon microbes.

The *iodide* of lead, used externally (for scrofulous and syphilitic swellings), probably acts chiefly by the iodine which it contains.

Lead *carbonate*, in solution in oil, has been recommended by English physicians as a good topical agent in erysipelas. It acts probably as the other preparations of lead (acetate, binoxide, tannate), as a siccative and an astringent, and its action on microbes consists in depriving them of the water which they require.

MAGNESIUM; ZINC; CADMIUM.

Magnesium exists in the organism with lime in the state of a phosphate; it is found also in the greater part of our foods. Hence the salts of magnesium are neither toxic nor antiseptic.

It is not so with *Zinc* and its salts. After mercury, gold, platinum, silver, zinc is, of all the common metals, the one which holds the first place in antisepsis—even before copper (Richet). The salts of zinc are poisonous in doses exceeding one gramme. It is well known that zinc vessels are unfit for cooking purposes, as water, wine, milk, and oil attack this metal.

Zinc chloride is considered as *strongly* antiseptic, but it probably owes its germicidal properties in a great measure to the chlorine it contains (equivalent, 1.6 grammes, according to Miquel). It is soluble in water and alcohol (*Burnett's solution* used in England). Being inodorous and comparatively cheap, it is used to disinfect hospital wards (solution 1:50), the holds of vessels, sewers, and water-closets (1:100). In medicine it is seldom used except externally as a caustic; solutions of 1, 5, 8 and 10 per cent. have been used as a dressing for ill-conditioned wounds and fistulas.

Zinc sulphate is also a good antiseptic (Jalan de la Croix)—inferior, however, to copper sulphate, but less caustic. It is employed in vaginal injections (Ricord) and in collyria.

Zinc sulphite, recommended by Henston and Tichborne, is a non-toxic and non-irritant antiseptic. An antiseptic gauze is prepared by saturating the material with this salt, and keeps a long time without alteration.

Zinc iodide, a very active compound, little used internally on account of its emetic and toxic action, is employed externally as a pomade.

Zinc oxide, mixed with corrosive sublimate (60 grammes to 6 decigrammes of the latter), is a good antiseptic, resembling in its properties iodoform (Benjamin). The oxide must be heated to 200° and, after cooling, mixed with corrosive sublimate.

The salts of *Cadmium* appear to have a toxicity and properties similar to those of the salts of zinc.

The *iodide of cadmium* is very strongly antiseptic (equivalent, 50 centigrammes, according to Miquel). It has been used in ointment.

Cadmium sulphate has been used in the place of zinc sulphate for collyria and in injections for blennorrhagia; its use appears to present advantages, at least in acute cases.

COPPER; MERCURY.

The salts of *Copper* are very poisonous, and are at the same time energetic antiseptics. *Copper chloride* ($CuCl_2+2H_2O$) and *copper sulphate* are *very strongly* antiseptic (Miquel), with equivalents of 70 and 90 centigrammes.

The *acetate* and the *phosphate* of copper in the nascent state have been recommended by Luton for tuberculosis. The *acetate* of copper (verdigris) is used as an escharotic to destroy rebellious ulcerations and vegetations of syphilitic origin.

Copper *sulphate* is more commonly used in solution, for external use, as an antiseptic or disinfectant, notably in discharges of uterine origin (Charpentier). The one-per-cent. solution is used for this purpose. It has the advantage of being less expensive and less dangerous than the solutions of corrosive sublimate.

Mercury and its salts are the most energetic antiseptics known, but they are at the same time the most toxic. We must distinguish, however, between the insoluble and the soluble salts; the bichloride (corro sive sublimate), which is soluble, is toxic in doses of 5 to 10 centigrammes, while the protochloride (calomel) is simply purgative in doses ten times greater—we should not forget, however, that in the presence of the chlorides of the gastric juice it may be transformed partially, and more or less rapidly, into the bichloride.

According to Miquel, the *biniodide* of mercury is the most powerful antiseptic known (equivalent, 25 centigrammes). The bichloride (corrosive sublimate) has only the fourth place (equivalent, 7 centigrammes).

Metallic mercury may be used, chiefly externally, in the form of *extinct mercury*, that is to say, mixed with a fatty body (lard, vaselin, or lanolin). The "resolutive" or antisyphilitic action formerly attributed to this topical agent must now be considered as an antiseptic action. A slight quantity of the

metal, which exists in a minutely divided state in mercurial pomade or *Neapolitan ointment*, is absorbed through the skin in inunctions. This ointment acts as an antiseptic in peritonitis, blennorrhagic orchitis, meningitis, lymphangitis, and local phlegmons. The absorption of the metal by the skin is proved by the characteristic salivation and by symptoms of poisoning which are sometimes very grave. Gubler and Merget think that in these circumstances the vapors of a metal which volatilizes at the ordinary temperature of the air may be absorbed by the digestive and pulmonary passages in considerable quantities, especially when the temperature of the human body reaches or exceeds 39 and 40 C., as is often the case with patients suffering from peritonitis or similar affections.

The *bichloride* ($HgCl_2$), or *corrosive sublimate*, is, of all the salts of mercury, the most commonly used as an antiseptic. At ordinary temperatures it requires fifteen parts of water or fourteen of glycerin to dissolve one of this salt, but in alcohol and ether it is much more readily soluble (1:4).

It will not do to use ordinary water to dissolve this salt, for the lime contained in the water would cause a more less abundant precipitation. If distilled water is not used, the tendency to precipitation may be counteracted by the addition of common salt.

Vicario and Deschamps have recommended, as

equivalent to the *Liquor Van Swieten*, the following solution:

Corrosive sublimate..................	1
Sodium chloride....................	1
Ordinary water......................	1000

Van Swieten's solution (French Codex) consists of one gramme of corrosive sublimate dissolved in one litre of water. It is in great favor among the physicians of France, being employed externally as an antiseptic and for injections into the vagina, uterus, etc. It may be dangerous in some cases to employ this preparation in full strength. The Academy of Medicine, in accordance with the report of Dr. Budin, has authorized midwives to use a solution of corrosive sublimate somewhat weaker than the liquor of Van Swieten.

Mercurial antiseptic is sold by the pharmacists in the form of powder, in little packages made according to the following formula:

Bichloride of mercury...............	0.250
Tartaric acid.......................	1.000
Bordeaux red........................	0.001

M.

Each package contains enough for one quart of water. The red color (Bordeaux red) is designed to attract attention and to prevent any mistake that might result in poisoning.

A sublimate vaselin, 1:4000, is used for lubricating the hands and instruments.

Laplace was the first to show (in 1887) that the addition of $\frac{5}{1000}$ of hydrochloric or tartaric acid to a solution of corrosive sublimate considerably augments its antiseptic power, by preventing the mercurial salt from forming an insoluble albuminate with the albuminoid matters of the tissues of the organism.

Corrosive sublimate, even in such minute quantities as 1:20000, destroys fully developed bacteria. Some bacteria are more susceptible to its action than others.

Protochloride of mercury, mercurous chloride, or calomel (Hg_2Cl_2), is insoluble in water, and this is why we are able to administer it in much larger doses than bichloride. In presence of hydrochloric acid and of alkaline chlorides, it splits up into mercury and bichloride, especially when organic matters are present. Its action, then, resembles that of the soluble mercuric compounds from the point of view of toxicity and antisepsis. The English physicians employ it frequently in diseases of children, for enteritis, meningitis, etc. It is also employed externally in the form of ointment.

The *black oxide* of mercury (mercurous oxide) is the basis of the "black wash," made by adding a drachm of calomel to a pint of lime-water.

The *mercuric oxide* or *binoxide*, in more general use, is red, and forms the basis of collyria and pomades for venereal ulcers and diseases of the eyes. It is the basis of the "yellow wash."

The *acid nitrate* of mercury (mercuric azotate), in solution with an excess of nitric acid, is employed as a caustic for syphilitic ulcers.

Mercurous iodide (Hg_2I_2) is green, insoluble in water; it is a favorite antisyphilitic remedy, and is given internally in doses of from ¼ to 1 grain.

Mercuric iodide (HgI_2) or the *biniodide* of mercury, is a much more active compound. It is a red powder, slightly soluble in water (one grain to the quart) and soluble in alcohol and ether. This is the most powerful of antiseptics thus far experimented with (equivalent, 25 milligrammes [Miguel]). According to Pinard, who has employed it in puerperal affections in place of corrosive sublimate, it gives better results than the latter. "The biniodide, eminently antiseptic, is less toxic in equal weights than the bichloride," says Bouchard. Pinard uses a solution of 1 to 4000, which corresponds as to toxicity to the solution of sublimate which the Academy thinks safe to put into the hands of midwives. As an antiseptic it is probably three times as active, in spite of its perfect innocuousness.

The *yellow subsulphate* of mercury, or turpeth mineral, is employed in ointment in parasitic affections of the skin. It is but little soluble in water, and insoluble in alcohol. Internally it acts as an emetic and purgative.

The *mercuric sulphide* (HgS), cinnabar or vermilion red, is insoluble in water and alcohol, and

volatilizes without melting. It is employed externally in pomades and fumigations.

The *black sulphide*, or Ethiop's mineral, which has the same formula as the preceding, is obtained by triturating sulphur with mercury; it is formed also by the action of hydrogen sulphide and of the alkaline sulphides on the mercuric salts. Its insolubility renders it little toxic.

This indicates the way to treat poisoning produced by the application of a mercurial ointment, especially when there is reason to suppose that the poisoning is due to absorption of mercurial vapors by the pulmonary passages. As an antidote, you will administer the sulphur mineral waters (Cauterets, Uriage, Enghien, etc.) which transform the soluble salts of mercury into insoluble sulphides. When these sulphur waters are administered in advance, there is a remarkable tolerance towards mercurial inunctions.

Other antiseptic mercurial preparations which belong to organic chemistry will be mentioned further on.

IRON; CHROMIUM; MANGANESE; NICKEL; COBALT.

The salts furnished by the metals of this group are in general only moderately antiseptic, and hence are rarely employed in this capacity. As an exception to this rule, chromic acid is very strongly antiseptic.

Iron and the *salts of iron* are not toxic, even in relatively large doses. Being found in the organism as well as in our foods, they are very feebly antiseptic; thus the *sulphate of protoxide* of iron has for its equivalent the high figure of 11 grammes per litre (Miquel).

In the *protochloride* and *protiodide* of iron the chlorine and iodine act probably as antiseptics, while the iron is a reconstituent of the blood. However this may be, we may say that the salts of iron are not in use as antiseptics. For external use, and for all local applications, the salts of copper are preferable, being much more active.

The salts of *Manganese* are essentially the succedanea of iron. I have already spoken of permanganate of potash, the most used of these salts and the most strongly antiseptic.

Chromic acid (CrO_3) crystallizes in beautiful red needles. It is deliquescent, of a styptic taste. It is an energetic oxidizer, for it inflames alcohol and ether by simple contact. Applied to the tissues, it is very caustic, and as such it is employed with an equal weight of distilled water to destroy corns and cauterize vegetations. Its antiseptic equivalent is almost as high as that of osmic acid, and superior to that of chlorine, being 2 decigrammes (Miquel).

Bichromate of potash is also an energetic oxidizer, as I have already said; it is strongly antiseptic.

Chromic acid and the salts of chromium are not in use as antiseptics.

The salts of *Cobalt* and of *Nickel* have properties similar to those of the preceding. The *sulphate of nickel* is strongly antiseptic, superior in this respect to permanganate of potash and especially to the sulphate of iron. Its antiseptic equivalent is a little inferior to that of chloride of zinc.

ALUMINIUM.

This metal resembles the preceding, although it is not diatomic but hexatomic, its salts having this grouping: $(Al_2)_6$. Very few of its salts are employed as antiseptics. Alum, a feeble base, is astringent.

The *double sulphate of alumina and potash*, $(SO_4)3Al_2SO_4K_2+24H_2O)$, when introduced into the digestive tube is toxic in the dose of 15 grains or even less. It is astringent, and is employed chiefly in gargles. Coagulating albumen, it prevents the putrefaction of organic matters.

Burnt alum, employed chiefly in powder, acts as an absorbent of water from the tissues on which it is deposited, and it is probably in this way only that it acts on bacteria, so sensitive to the least change in the degree of concentration of the liquids in the midst of which they live. It is not considered as a true antiseptic.

The *acetate* of alumina is, on the contrary, considered as a powerful antiseptic. I shall speak of it again with the other organic compounds derived from acetic acid.

GOLD; PLATINUM; OSMIUM.

The salts of gold were formerly employed in scrofula and in syphilis. Recent researches, in showing the elevated antiseptic rank of gold and its compounds, tend to restore this metal to its former therapeutic importance. The sole obstacle to the employment of the salts of gold is their high price.

Gold in powder, the chloride and bromide of gold, alone or in combination with ammonium or sodium, the cyanide and the oxide of gold, have been employed internally and externally in doses indicated in the Codex. Chloride of gold is a caustic which has the reputation of not leaving cicatrices; it is soluble in water, alcohol, and ether. It is strongly antiseptic. In Miquel's list it follows iodine and chlorine, with an equivalent of 25 centigrammes, equal to that of these two metalloids.

Cyanide of gold, formerly prescribed by Chretien, has again been employed by Œsterlen in phthisis; this salt is yellow, insoluble. It is given in the dose of 4 to 16 milligrammes ($\frac{1}{15}$ to $\frac{4}{15}$ grain).

The *tricyanide of gold*, colorless and soluble, has also been employed by the same authority.

The salts of *Platinum* resemble the salts of gold by their properties, but they are less active, while being very costly. *Bichloride* of platinum has for antiseptic equivalent 30 centigrammes, a figure higher than that of hydrocyanic acid.

Osmium is used only in the form of *osmic acid*

(OsO_4), a volatile body at ordinary temperatures (giving off the vapors of osmium), which gives it a resemblance to mercury; it dissolves slowly in water. It is an energetic oxidizer, very easily decomposing, with metallic reduction, in contact with organic matters. It is irritant by contact of its vapors, and caustic in large dose. It is an energetic antiseptic, superior to the preceding, and taking rank, according to Miquel, immediately after nitrate of silver (antiseptic equivalent, 15 centigrammes).

Much employed in micrography and in bacteriology to define the tissues and lower organisms, osmic acid, by reason of its high price, is not used in therapeutics. It has been employed in hypodermatic injections as an antineuralgic (in 1-per-cent. solution).

M. Maggi employs osmic acid in the analysis of potable waters, as it kills instantly all the microbes and precipitates them to the bottom of the vessel, where it is easy to collect them.

CHAPTER II.

ANTISEPTICS BORROWED FROM ORGANIC CHEMISTRY.

Generalities and Classification.—The antiseptics borrowed from organic chemistry are to-day much more numerous and varied than those of the inorganic field; it is, then, necessary to make of them a serious study—a study which is rendered peculiarly difficult by their very complex constitution and the often fanciful names applied to many of them—names which have no relation to the chemical formula under which they are known.

By organic chemistry was formerly understood the description and properties of bodies extracted from the organs of plants and of animals. To-day, now that bodies of the same nature have been obtained artificially by the aid of minerals, we say that organic chemistry is *The science of all the carbon compounds* (Grimaux).

In these compounds, carbon is associated with the three simple bodies, hydrogen, oxygen, and nitrogen, and these four elements, of themselves alone, by the difference in their respective proportions, furnish already many thousands of organic compounds. But they are capable besides of uniting with sulphur, phosphorus, almost all the metalloids, and several

metals, thus augmenting still more the number of the organic compounds with which we are here concerned.

The recent researches of Rottenstein and Bourcart* have shown that the antiseptic power of the organic substances depends on the *grouping of the atoms* of C, H, O, N, etc., which constitute their chemical molecule, but especially *on the number of these atoms.*

The antiseptic power of an organic compound is directly proportional to the number of hydrocarbon groups (naphtyl, phenyl, methyl) or of halogens (chlorine, bromine, iodine) which are found linked together in the elementary molecule of the chemical compound.†

The greater the number of times a combination contains the hydrocarburets CH_3, C_6H_5, $C_{10}H_7$, and their derivatives, the greater is its bactericidal power. The group naphtyl ($C_{10}H_7$) is about twice as antiseptic as the group phenyl (C_6H_5), and the latter is five or six times more energetic than the group methyl (CH_3).

Oxygen combined with C and H, and even with N, *much augments* the bactericidal powers of the derivatives of these hydrocarbons.

Nitrogen, on the contrary, combined with one or

---

* Rottenstein and Bourcart, "Les Antiseptiques," etc. Paris, 1891.

† Rottenstein and Bourcart, *loc. cit.*

two atoms of hydrogen *always lowers the antiseptic power* of an organic combination.

I must make exception to the cyanogen group (CN), which behaves as a halogen element and appears to be at least as active as chlorine; as well as to the ammonium group (NH_3), which behaves as a metal. Both are violent poisons, and their organic compounds present similar properties.

The substitution, in an amide group (NH_2), of an antiseptic group (naphtyl, phenyl, etc.) for one or two hydrogens, immediately raises the bactericidal nature of the compound.

Lastly, when we study the action of antiseptics on the microbes, we must distinguish two things: (1) the effect of the composition of the substance *directly* on the bacteria; (2) the effect of the products of the decomposition of these substances by the bacteria on the bacteria themselves. The first case is applicable to all substances containing halogens (Rottenstein and Bourcart).

These general considerations shed a vivid light on the study of the organic antiseptics, and to such a degree that (in the words of the writers cited above) "in the future it will be possible, as soon as we know the chemical constitution of a substance, to establish not only the antiseptic power, but also to compare this power with that of other substances already classed."

From the point of view of the toxic equivalent of

antiseptics, there is a final general observation to make. Bouchard has remarked that in inorganic chemistry the mixture of several antiseptics gives a product more antiseptic, *without being more toxic*, than each one of the antiseptics taken separately. This law finds its application in organic chemistry, with this difference, that the organic antiseptics are *well defined chemical compounds* and not simple mixtures. Thus it is that iodoform is much less toxic than pure iodine administered in the dose in which it enters into the composition of the organic molecule, CH_3I, which acts, besides, by its methyl radical.* This it is that legitimizes the preference which is given to-day in antisepsis to the complex bodies of organic chemistry over the simple bodies of mineral chemistry.

We shall study the antiseptics of organic origin in the following order:

1. Saturated hydrocarbons, fatty series or derivatives of methane, alcohols, ethers, and organic acids.
2. Aromatic series, or derivatives of benzine.
3. Alkaloids.

Most of these latter, though having numerous applications in medicine, do not, strictly speaking, belong to antiseptic therapeutics.

---

* According to the formula of Dujardin-Beaumetz and Yvon, iodoform may be given internally in the dose of 10 to 20 centigrammes, while pure iodine is toxic in a larger dose than 1 to 5 centigrammes. Iodoform contains 90 per cent. of iodine.

§ 1. SATURATED HYDROCARBONS, FATTY SERIES OR DERIVATIVES OF METHANE.

The saturated hydrocarbons, of which marsh gas (CH_4) is the best known type, constitute a numerous series of bodies represented by the general formula: $C_nH_{2n}+_2$. These bodies differ from each other only by the number of units of the radical CH_2, and present a great similarity of properties. Treated by chlorine, they furnish products of substitution (hydrochloric ethers); then, under the influence of appropriate reagents, homologous alcohols, etc. We must refer the reader to treatises on chemistry for the detail of these divers reactions, which furnish a great number of organic compounds, gaseous, liquid, or solid, at the ordinary temperature, and of which several are considered as antiseptics. Such are *paraffin*, *petroleum*, *vaselin*, *alcohol*, *chloroform*, etc.

PETROLEUM.

Crude petroleum, which is so well known, is a natural mixture of saturated hydrocarbons which may be purified by successive distillations. It is toxic.

According to the researches of Dubief; crude petroleum prevents the development of aërobic microbes, notably those of suppuration, but does not act on the spores of *Bacillus anthracis*. Its antiseptic power is but moderate.

Petroleum has been recently recommended as useful for swabbing the throat and for gargles in

diphtheritic angina. Its use is well tolerated, notwithstanding the bad taste of the liquid, and the results obtained (forty-two cases, forty recoveries) are very encouraging.* Petroleum softens and detaches quite rapidly the false membranes.

VASELIN.

Vaselin, or petrolin, is a mixture of paraffin and the heavy oils of petroleum. By reason of its chemical composition, it does not become rancid like the fats, and ought to replace these in all ointments designed for antiseptic uses.

ALCOHOLS: METHYLIC, ETHYLIC, ETC.

Methyl alcohol (CH_4O) is the product of the dry distillation of wood, just as ethyl alcohol (C_2H_6O) or the spirit of wine is the product of the distillation of wine (juice of the grape and other sweet juices, as beets, sugar-cane, etc.).

Dujardin-Beaumetz was the first to show that the toxic equivalent and the antiseptic equivalent of the alcohols increase simultaneously and proportionally to their atomic formula,† as the following table indicates:

	Degree of Asepsis.
Ethylic alcohol, C^2H^6O	95
Propylic alcohol, C^3H^8O	60
Butylic alcohol, $C^4H^{10}O$	35
Amylic alcohol, $C^5H^{12}O$	14

* Larcher.

† Dujardin-Beaumetz and Audigé, "Experimental Researches on the Toxic Power of the Alcohols." Paris, 1879.

It is very difficult to obtain these alcohols in a state of absolute purity in commerce. This explains the differences which are remarked between these figures and those given by Bouchard. According to the latter authority* methyl alcohol (CH_4O) is the least toxic and probably the least strongly antiseptic of all the alcohols. This is what its chemical formula indicates. At the same time we should remember that man is habituated to the ethyl alcohol, which predominates in wine, and antiseptic effects are modified by accustomance.

Alcohol being very often employed as an excipient or to promote the solubility in water of antiseptic substances which are not soluble in the latter liquid, we easily understand the importance of these figures.

But alcohol is also employed in therapeutics in order to obtain the special action which it exercises on the organism, independently of the other substances which may be associated with it. The query is then pertinent in this place: Does alcohol possess in itself an antiseptic action?

It is especially by the oxygen which they contain that the alcohols ought to be considered as bactericidal, so that the greater the amount of oxygen there is in combination with hydrogen, the more antiseptic the alcohol will be. Thus, the alcohols with several

---

* Bouchard, "Therapeutique des Maladies Infectieuses," p. 222.

hydroxyles (OH) will be more antiseptic than those that contain but one. The hexatomic alcohols which contain six groups OH, such as mannite ($C_4H_{16}O_6$), would then theoretically be more strongly antiseptic than the monoatomic alcohols, like ordinary alcohol. We have not yet made experiments in this direction, the derivatives of methane (CH_3) being moreover considered as feeble antiseptics; in other words, the group CH_3 does not give of itself any great antiseptic value to a compound, and the presence of oxygen does not materially raise this value when we come to the matter of utilizing these compounds in the practice of antisepsis.

However this may be, the antiseptic action of ethyl alcohol has often been utilized in medicine, as in the dressing of wounds, etc., to oppose putrefaction and fermentation. Gubler says its properties are due essentially to its greed for water and its power of coagulating albumens. Internally it acts as a diffusible stimulant, a respiratory aliment, and producer of force (*dynamophore*). Its action is probably more complex still.

Many facts tend to prove that alcohol acts chiefly on the non-figured ferments which resemble diastases. Alcoholic solutions of 10 to 33 per cent. retard or arrest the action of these ferments; and if it be remembered that the toxines secreted by the microbes have often the chemical nature of diastases, it may be asked if alcohol does not act in infections, in part at least, by neutralizing these toxines?

We know that the most efficacious internal treatment yet known for general poisoning produced by the venom of serpents communicated by a bite, consists in giving alcohol in large doses. The patient is literally made drunk, and he is kept in a state of intoxication till the general symptoms are improved. So also in pneumonia, the alcohol which is administered in the form of whiskey or brandy may be regarded as exerting an influence (however little or great) on the toxines secreted by the microbes which pullulate in the diseased lung.

The action of alcohol on the microbes themselves, however feeble this may be, should also be taken into account. According to Jalan de la Croix, a 5:100 solution of alcohol prevents the development of bacteria in a culture-bouillon, while it needs 22:100 to destroy them when they are in full development, and 83:100 to sterilize the germs of the latter. A solution of 5 per cent. prevents the development of bacteria in a mixture of raw meat and cold water. Before the dressing of wounds by phenic acid was popularized by Lister in 1873, surgeons daily employed alcohol diluted with water, or containing other substances in solution as antiseptic as itself, such as camphor, arnica, etc., for their dressings. At the present time, alcohol more or less diluted enters as a solvent in the phenicated solutions which have replaced the preceding, and in a great number of other antiseptic solutions of which I shall speak farther on.

GLYCERIN: $C_2H_5(OH)_3$.

Glycerin is a triatomic alcohol, very much employed to-day in therapeutics, pure or associated with other medicaments to which it serves as an excipient. It is soluble in water and in alcohol. Its solvent properties are intermediate between those of alcohol and those of water. It dissolves a great number of metallic salts and other substances.

Glycerin preserves organic matters in the same manner as alcohol, but its bactericide equivalent is much more feeble. It prevents the development of most bacteria, but favors that of the tubercle bacillus (Bouchard). It acts probably largely by its avidity for water, which it takes from the organic cells with which it is put in contact. It is a very feeble antiseptic (equivalent, 225 grammes, according to Miquel).

Bouchard has shown that glycerin is a bad excipient for hypodermatic injections. It produces albuminuria and hæmoglobinuria. On the contrary, it is better to use glycerin than alcohol for phenic solutions, for alcohol diminishes the antiseptic power of phenol.

CHLOROFORM: $CHCl_3$.

Chloroform, or methyl chloride, trichloride of methane, should be considered as a hydrocarbon of the formula of methane (CH_4), or marsh gas, of which an atom of H is replaced in the chemical molecule by three atoms of chlorine.

Chloroform is a very mobile liquid, more dense than water, in which it is little soluble (1 part to 100); soluble in every proportion in alcohol and ether; insoluble in glycerin. Applied pure to the skin and mucous membranes, it rapidly produces vesication; even when diluted with water it produces a marked rubefaction.

It is a good antiseptic, the action of the chlorine being added to that of the hydrocarbon. Miquel classes it as strongly antiseptic (equivalent, 80 centigrammes). In the dose of 1 per 100 it paralyzes bacteria and prevents their development; to sterilize germs, equal parts of chloroform and water are required.

Chloroform water, obtained by agitating chloroform and water and decanting, is a 1-per-cent. solution, and is employed in full strength or diluted as an antiseptic and analgesic of the digestive tube.*

CHLORIDE OF ETHYL BICHLORIDE: $C_2H_3Cl_3$.

Ethane-trichloride, or chloride of ethyl bichloride, according to its composition (an extra CH_3) is a more energetic antiseptic than chloroform. It is not used in medicine.

---

* Note that chloroform is the first term of the series of halogen compounds of methane which we are to study successively in passing to compounds that are of progressively increasing energy due to the adjunction of a greater number of atoms of hydrocarbons and of halogen radicals.

The *sesqui-chloride of carbon* (C_2Cl_6), a perchloride derivative of the preceding, has been employed with success in cholera in the dose of 25 centigrammes every half-hour during the algid period. It is a crystallizable body with the odor of camphor.

CHLORAL: C_2HCl_2O.

Chloral, or aldehyde-trichloride, is liquid, but is only employed in medicine in the form of chloral hydrate (C_2HCl_2O, H_2O), which is in white, hard, crystals, melting at 48° C., and subliming at the ordinary temperature, giving off a penetrating odor.

Chloral, containing in its molecule only two atoms of chlorine, is an antiseptic less energetic than chloroform, which has three, but it also acts by its atom of oxygen. According to Miquel, it is moderately antiseptic, with the equivalent 9.30 grammes.

According to Dujardin-Beaumetz and Hirn, one part of chloral suffices to arrest the fermentation of one hundred parts of putrescible matter. This corresponds well to the antiseptic equivalent given by Miquel.

Its solubility in water renders it of advantage for the dressing of gangrenous and fetid wounds (solution of 1 per 100), and for injection in empyema after the evacuation of pus.

TRI-CHLORACETIC ACID: $C_2HCl_3O_2$.

This body, though a good antiseptic, is not in use. It acts by the chlorine and the acetic acid

which it contains. It is solid, in colorless crystals, of agreeable odor, a little pungent; soluble in water and alcohol; very caustic; in concentrated solution it coagulates albumen. In solution of 1 or 2 per 100 it destroys all the micro-organisms; in weaker solutions it prevents the development of bacteria, but not the action of the non-figured ferments. Its antiseptic power would place it immediately after corrosive sublimate and phenic acid.

IODOFORM: CHI_3.

Iodide of methyl biniodide, or iodoform, is in yellow crystals, which are insoluble in water. Its strong, penetrating and persistent odor is the only disadvantage that this antiseptic presents, which for several years has almost entirely replaced carbolic acid in surgical practice. It is soluble in boiling alcohol (12 per 100), ether (6 per 100), chloroform, benzene, the fixed and volatile oils; insoluble in glycerin.

It is strongly antiseptic, with an equivalent of 60 centigrammes (Miquel). It is believed to act by becoming decomposed in contact with the tissues, first into iodates and iodides of sodium and potassium, then by the setting free of iodine in the nascent state (it contains 90 per cent. of iodine by weight). It is an energetic stimulant to cicatrization. It would be very interesting to know what is its action on the leucocytes, embryonic cells, or migratory cells which

constitute pus.* It certainly seems to limit the suppuration of bleeding surfaces. It is employed in the form of powder, iodoform gauze, iodoform collodion, etc. The dose for internal administration would be one to two grains three times a day, in pill form, but it is comparatively little employed internally. Dissolved in the oil of sweet almonds, it may be used as a collutorium in septic angina.

Many ways have been devised to mask the odor of iodoform. Thus, some associate one part of ground coffee with two of iodoform. Phenic acid, camphor, essence of peppermint, have all been recommended; menthol, creolin, vanillin, in some measure remove the offensive odor. Perhaps nothing better fulfills the object sought than camphor—one part to five or ten of iodoform. Cases of poisoning by iodoform when used externally have been reported, and it is well to be careful not to sprinkle it very lavishly over large ulcerated surfaces.

IODOL: C_4I_4NH.

Iodol, which as an *amine* or *ammoniacal compound*, is a good antiseptic. It is a crystalline powder, yellowish-brown; tasteless; very slightly soluble in water (1 to 5000); soluble in alcohol, ether, the oils, and

*It promotes the phagocytic activity of leucocytes; it represses the activity and development of pus-microbes. (See the recent experiments of Maurel as recorded in Boston Medical and Surgical Journal, Oct. 19, 1893).—TRANSLATOR.

alcohol and glycerin. It has been used for the same purposes and in the same manner as iodoform (powder, glycerin containing the powder in suspension, iodol-vaselin, iodol-gauze, etc.), and the results have been very satisfactory, except in gangrenous ulcers. A. Trousseau has used it to advantage in ocular therapeutics.

This preparation contains 88 per cent. of iodine —almost as much as iodoform. Its advantages over iodoform are its absence of odor, its less irritant action, and its perfect innocuousness. It would seem to be much safer than iodoform; it is, however, more expensive.

IODOPHENINE.

This compound, which resembles the preceding, is soluble in acetic acid (1 to 20) and in alcohol, but almost insoluble in water. It contains 50 to 60 per cent. of iodine. In solution of 1 to 5000 it kills the microbes of pus (*staphylococcus aureus*) after a contact of five minutes (Scholvien).

BROMOFORM: $CHBr_3$.

Bromoform, the analogue of chloroform and iodoform, is a colorless liquid, very dense, of quite agreeable odor, more powerful as an anæsthetic than chloroform. It has been vaunted as specific in whooping-cough.

It is a powerful antiseptic, and has been used with success in the treatment of diphtheria. Its

action is both antiseptic and anæsthetic. But bromol is generally preferred.

BROMOL: $C_6H_3OBr_3$.

Bromol, or tribromophenol, belongs to the aromatic series, but I shall speak of it here on account of the relations it bears to bromoform. Its composition indicates that it is a much more energetic antiseptic.

It is a powder of lemon-yellow color, of sweet and astringent savor, with characteristic but not disagreeable odor; insoluble in water; soluble in glycerin, alcohol, ether, chloroform, and the essential oils.

Although little toxic, this body possesses marked antiseptic properties: a piece of meat dusted over with bromol keeps without spoiling for several days at the temperature of 30° C. (86° F.).

It is employed externally as a dressing for ulcers and wounds, in powder or mixed with vaselin. In infectious anginas it has the advantage of being soluble in glycerin. It has also been employed in typhoid fever, cholera infantum, abscess of the lung (Rademaker).

In short, bromol is the best antiseptic we have yet studied, and it might with good reason be substituted for iodoform, having neither the disagreeable odor nor the toxic action of the latter. In iodol the radical NH lowers the antiseptic power, while in the molecule of bromol *all is utilized for antisepsis.*

ORGANIC ACIDS.

The organic acids, like the preceding compounds, are antiseptics which are the more powerful the greater the number which their molecule contains of groups of COOH, OH, CO, COH, and CH_3, C_2H_5, so that we may range them in the following order:

Formic acid, CH_2O_2.
Acetic acid, $C_2H_4O_2$.
Lactic acid, $C_3H_6O_3$.
Tartaric acid, $C_4H_6O_6$.
Citric acid, $C_6H_8O_7$.

The first acid of this series being the least antiseptic, and the last the most antiseptic, this law, which is the corollary of that which we have announced for all the compounds of methane, is similar to the law governing the antiseptic power of the alcohols, and sufficiently explains the action long since known of citric acid on the pathogenic microbes.

Formic acid, according to Schulz, in 1-per-cent. solution prevents the putrefaction of pancreas, and in 0.25-per-cent. that of fibrin. Schulz has, by means of this acid, kept a culture liquid free from the development of germs for six months.

Acetic acid has been used by Roth and Angelmann as antiseptic and disinfectant. According to the latter, a 3-per-cent. solution is a good antiseptic to employ in gynæcology, as being much less toxic than phenic acid. For external use we may increase the strength of the solution to 20 per cent. Acetic

acid is the basis of numerous aromatic vinegars employed as lotions. On the whole, it is a feeble antiseptic.

Several *metallic acetates* are employed in medicine; their action is due both to the acid and to the metal of their composition (acetate of lead, acetate of copper, etc.).

Lactic acid has been prescribed by Hayem and Lesage as antiseptic in the "green diarrhœa" of infants. Their formula is two parts of lactic acid to one hundred of the vehicle (syrup or mucilage), in teaspoonful doses.

It has also been employed as a topical agent in diphtheria, in tuberculous ulcerations of the larynx, and in epitheliomata.

Oxalic, *tartaric*, and *citric* acids are placed in almost the same rank by Miquel, among the *strong* antiseptics; they are, however, less active than the mineral acids, and the latter less so than the acids of the aromatic series (salicylic and benzoic). Their equivalent varies from three to five grammes per litre of culture bouillon.

Oxalic acid has been prescribed externally and internally in diphtheria. A good solution for swabbing the throat is one part of acid to twenty of water or one hundred of glycerin.

Tartaric acid is not used as an antiseptic. The bitartrate (cream of tartar) is employed as a purgative in the dose of one-half ounce to one ounce. The

double tartrate of potassium and sodium (Rochelle salt) is given in the same dose, or in somewhat larger doses. The tartrate of antimony and potash, or tartar emetic, is employed as an emetic and purgative in the dose of one-half to three grains, and in smaller doses as a sudorific, sedative, and expectorant. It is a very active and very untrustworthy medicament, whose local action on the digestive tube and general action on the organism should be watched.

Citric acid is, as its formula indicates, the most efficacious antiseptic of the series. It presents itself under the form of white crystals, soluble in three-fourths their weight of cold water, in alcohol, and in ether. It is extracted from the juice of lemon. It also exists in currants, strawberries, raspberries, cherries, and oranges.

The antiseptic equivalent of citric acid is 3 grammes to a litre of culture bouillon; *i. e.*, about the same as that of the mineral acids, hydrochloric and acetic, with the difference that citric acid is much better supported by the organism. Thus, one may give two to six grammes per day internally, while it is not safe to exceed one or two grammes of hydrochloric acid diluted in at least a quart of water. However, citric acid is only employed as a topical agent.

Under the form of lemon-juice, citric acid was formerly used to touch ulcers affected with hospital gangrene. It is chiefly employed to-day as a gargle in pseudo-membranous anginas.

CYANOGEN AND CYANIDES.

To the group of ammoniacal compounds (amides and nitriles) are related the compounds of the group CN (cyanogen), which behaves in its combinations like a simple body, a metalloid of the same group as chlorine, iodine, and bromine.

Hydrocyanic acid (CNH) is the *nitrile of formic acid.*

All bodies which contain the radical CN or Cy are energetic antiseptics, but at the same time extremely violent poisons, more toxic than mercury and its salts; and this singularly restricts their employment in therapeutics. Were it not for this toxicity, we might employ the cyanides as we employ the chlorides, iodides, and bromides. According to Miquel, the cyanide of potassium is strongly antiseptic (equivalent, 1.20 grammes). The cyanide of mercury is still more energetic, and hydrocyanic acid has for an equivalent 0.40, a figure however inferior to that of iodine (0.25) and only about one-sixth that of corrosive sublimate (0.07).

Cyanide of mercury ($HgCy_2$) has been employed as an antiseptic internally. Erichsen, Annuschat, Rothe and Schultz have prescribed it in diphtheria in very minute doses (1 to 10 centigrammes in 120 grammes of peppermint-water; dose, a teaspoonful every hour). The ferrocyanides have not been employed as antiseptics.

SULPHIDE OF CARBON AND ORGANIC SULPHUR COMPOUNDS.

The bisulphide of carbon (CS_2) is a heavy liquid, very slightly soluble in water. At the same time, on agitating it with water, and leaving the water in contact with the sulphide in excess, we obtain *bisulphide of carbon water*, prized by Dujardin-Beaumetz as an antiseptic in putrid dyspepsia.

Sulphocarbol, sulphaminol, sulphobenzoate of soda, sozoiodol, etc., belong to the aromatic series, of which we are now to speak.

§ 2.—HYDROCARBONS OF THE AROMATIC SERIES, OR DERIVATIVES OF BENZENE.

Benzene (C_6H_6), or *benzol*, is the first term and the base or nucleus of a numerous series of compounds very important for us, for they are all more or less antiseptic, and some of them are probably the best antiseptics which organic chemistry furnishes. As these bodies have all a strong and aromatic odor, and many even are essences, the name *aromatic* has been given to this series.

To show the importance of the aromatic series in therapeutics, it suffices to say that the phenols, the naphthols, salicylic acid, and all their derivatives, so much employed the last few years, belong to this

group of organic compounds. To facilitate the study of this numerous series, we shall pass successively in review, in the order which we indicate below:

1. The aromatic hydrocarbons (methyl group).
2. The oxygenated hydrocarbons (group phenyl) and the aromatic acids associated with them.
3. The hydrocarbons of the group naphtyl.
4. The hydrocarbons of the group of ketones and quinones.
5. The hydrocarbons containing hydrogen.

With each of these different groups we shall study the haloid and sulphur compounds which belong to them.

AROMATIC HYDROCARBONS (GROUP METHYL: CH_3), BENZOL, TOLUOL, ETC.

The hydrocarbons of this group are feebly antiseptic, their bactericidal power increasing in proportion as the hydrogen is replaced in the benzol (C_6H) by CH_3 or other antiseptic groups. In studying successively benzol, toluol, xylol, mesithylene, hexamethyl-benzol, we pass progressively to compounds more and more energetic.

Benzol (C_6H_6), or benzene, which everybody knows, is a colorless liquid of quite agreeable odor when it is pure, almost insoluble in water, very soluble in alcohol and ether. It dissolves iodine, sulphur, phosphorus, camphor, and most of the organic substances rich in carbon. It is not used in medi-

cine. Toluol and the other compounds enumerated above are also not used as antiseptics. Their properties resemble those of benzol. All are very volatile and inflammable.

ANILIN AND FUCHSIN.

Among the derivatives of benzene and nitrobenzene (essence of mirbane), anilin is one of the most important in the arts. From it is derived fuchsin, or anilin red, a product now for several years utilized in therapeutics.

Fuchsin is obtained by treating anilin with oxidizing agents (nitrate of mercury, arsenious acid). This body is a chloride of rosanilin, as its formula shows: $C_{20}H_{13}N_3HCl$. It presents itself under the form of crystals of a greenish-red color, the solutions of which are a beautiful violet-red, which fixes itself readily on all organic substances and colors them solidly without any need of a mordant.

Fuchsin is employed externally and internally as an antiseptic.

It has been used internally in the treatment of Bright's disease (Feltz and Ritter). It is given in capsules in the dose of 2 grains (0.12) twice a day. This medicament colors the urine red, and is always well supported.

Fuchsin is employed externally in the treatment of chronic and rebellious ulcers. It acts both as an

antiseptic and as an analgesic. It is applied in solution as follows:

Fuchsin	....	0.70
Alcohol } Water }	ää	215.

M. For external use only.

After painting, cover the sore with a piece of gauze soaked in the same solution, and over this place a little isinglass plaster, absorbent cotton, and a bandage. This medicine has no inconvenience but its color, which long stains the skin red.

OXYGENATED HYDROCARBONS, PHENOLS AND OXYBENZOLS (PHENYL GROUP: C_6H_5).

These compounds, like the aromatic acids, are, as we have said, five or six times more antiseptic than the benzols and analogous compounds. They have, besides, the advantage of being for the most part soluble in water.

Tannin, phenol, creasote, guaiacol, salol, and thymol belong to this group, and possess bactericidal properties which are of increasing efficacy in the order in which we have named them.

TANNIN.

Tannin, or tannic acid ($C_{14}H_{10}O_9$), is an amorphous powder, of a grayish-yellow color, behaving as an organic acid. Employed formerly as an astringent (of which class of vegetal medicaments it is the

type), it is now also used for its antiseptic properties, brought to light by Raymond and Arthaud in the treatment of tuberculosis. (These practitioners give doses of one to five grammes per day.) As an antiseptic it is superior to pyrogallic acid (equivalent, 4.80 grammes, according to Miquel). Tannin has been employed externally in blennorrhagia, leucorrhœa, and furunculosis.

Tannate of bismuth is employed as an anti-diarrhœic medicine; *tannate of lead*, in powder, for eschars of the sacrum; *tannate of zinc* for inveterate blennorrhagic discharges.

Rhatany, *kino*, *catechu*, and multitudes of other vegetable productions owe their astringency to tannin, which they contain in variable proportions.

PHENOL, PHENIC ACID, CARBOLIC ACID: C_6H_6O.

Phenol, or phenic acid, is not a true acid. By its properties it resembles the alcohols, but it has actions which are peculiar to it alone. There exist a great number of phenols, which all possess the property of combining with chlorine, bromine, iodine, and sulphur, the most of which are good antiseptics.

We obtain phenol from coal-tar, in which it exists ready-formed. It is solid, crystallized, melting at 34° C. Its odor is disagreeable; its savor is caustic; it attacks the epidermis, causing white superficial eschars, accompanied by burning and itching. It dissolves in twenty times its weight of water, and is

more soluble in alcohol and glycerin, the oils and ether. It is employed in pharmacy under three forms: (1) Crystallized phenic acid; (2) Absolute purified phenol, soluble in fifteen parts of cold water; (3) Liquid phenic acid, a mixture of 90 per cent. of phenic acid and 10 per cent. of alcohol, soluble in 18 per cent. of cold water; (4) Impure, colored phenic acid, which should only be employed as a disinfectant of contaminated places. For antiseptic purposes, only the absolute phenol should be employed, which is phenol in its purity.

It is given internally in the dose of 7½ to 15 grains (0.50 to 1 gramme), well diluted. The phenic water is a 1:1000 solution, and is convenient for internal use—dose, a tablespoonful. For surgical purposes the 5:100 solution of the U. S. P. is preferable:

Glycerite of carbolic acid............ ʒ x.
Distilled water..........q. s. to make Oj.

M. Each drachm contains one grain carbolic acid. Dose, one to two drachms.

Carbolic poisoning manifests itself by headache, vomiting, convulsions, black discoloration of the urine, and death may supervene in the midst of collapse.

The solutions in glycerin and oil and the pomades irritate the skin much less than the alcoholic or watery solutions, and simple cerate is a better excipient than vaselin.

According to Miquel, phenol, although strongly

antiseptic (equivalent, 3.20 grammes), is less so than the mineral acids, and a little more so than permanganate of potassium. Thymic, picric, benzoic, and salicylic acids are preferable in this respect. The popularity which this antiseptic enjoyed during the first twenty years of its use has considerably declined of late. Its internal use has been almost abandoned since we have known of naphthol, and for external use we now prefer salol and iodoform.

M. Gaucher has recommended as a topical application in diphtheria a mixture of camphor and phenic acid (5 to 10 parts of acid, 20 to 30 parts of camphor, 10 parts of alcohol, and 10 of olive oil). This liquid is caustic; hence the weaker solutions should generally be preferred. The *camphorated naphthol* is, in fact, a better antiseptic for swabbings and paintings in diphtheria.

CREASOTE; CRESYLOL; CRESALOL.

Creasote is an inconstant mixture of creosol, guaiacol, cresylol, and other aromatic principles of tar. It might be well, therefore, in therapeutics, to substitute guaiacol, which is superior to it as an antiseptic and is a well defined product, though more toxic.

Beechwood creasote is an oily, yellow liquid, of a strong and not very agreeable odor, pungent and caustic taste; little soluble in glycerin, much more so in the oils and alcohol. In 1:100 solution it sterilizes

germs. It is employed internally in tuberculosis and chronic bronchitis, of which it diminishes or dries up the muco-purulent secretions remarkably. It has been used in surgery to dress ill-conditioned wounds.

Creasote-water is employed like tar-water, and for the same purposes; creasote is one of the active constituents of tar. Internally, creasote is often given in drop doses as an anti-emetic.

Cresylol, *cresol*, or *cresylic acid* (C_7H_8O), is one of the active principles of creasote, of creolin, and of lysol. It is a monoxybenzol, and consequently a homologue of phenic acid, to which it is superior as an antiseptic. It is a liquid, with a strong odor of creasote; is insoluble in water, soluble in alcohol and glycerin. Of its salts, *cresylate of soda* is alone used.

Although more active than phenol, cresylol is less toxic, and may be substituted in the same dose for the former.

Lysol and *creolin* are impure products which can only be used as disinfectants. Creolin, little soluble in water, is employed in emulsion; lysol is soluble in almost any proportion.

Cresalol, or *salicylate of cresol* ($C_{14}H_{12}O_3$), is much more antiseptic than cresylol, owing to the presence in it of salicylic acid. Three isomeric compounds are known, which are all in the form of white powder, light, crystalline, insoluble in water, ether, and the oils.

Metacresol is preferable to iodoform for the

dressing of wounds; it gives as good results, and is less toxic, is a better diminisher of the secretions, and has no disagreeable odor.

Cresolated gauze is used in the same way as iodoform gauze.

RESORCIN AND OTHER DIOXYBENZOLS.

The phenols of this group are more active than the preceding. The principal are pyrocatechin, resorcin, and hydroquinone. Resorcin alone is used in medicine.

Resorcin ($C_6H_6O_2$) is crystallized; very soluble in water, alcohol, and ether. Its great solubility in water, and its little causticity, render it very valuable for external use. Its odor is almost *nil*, and its taste is sweet. Given internally, it is not toxic, although its antiseptic power is greater than that of phenic acid (Callias). A 5-per-cent. watery solution is employed for swabbing and spraying in diphtheria. Resorcin cotton and resorcin gauze are used as dressings in surgery. There is also an ointment (10-per-cent.) much in use in diseases of the skin (eruption of scarlatina, of smallpox, etc.).

PYROGALLIC ACID AND OTHER TRIOXYBENZOLS.

The phenols of this group—pyrogallic acid, phlocoglycine, etc.—are still more active than the preceding; they are little used in medicine.

Pyrogallic acid is toxic by reason of its avidity for oxygen, which it takes from the blood, producing

accidents resembling those of poisoning by phosphorus. A solution (2-per-cent.) of pyrogallic acid prevents the development of micro-organisms. It has been employed externally with benefit, notably in lepra and other affections of the skin. It is a good disinfectant, but it stains the skin and blackens surgical instruments.

GUAIACOL AND OTHER DERIVATIVES OF DIOXY-BENZOLS.

Guaiacol, or *methyl-catechol* ($C_7H_8O_2$), is, as we have said, one of the principal constituents of creasote. It is a colorless liquid, with odor resembling creasote, little soluble in water, very soluble in alcohol and the fixed oils.

Guaiacol is more antiseptic than cresylol, and it is probable that to it creasote owes its antiseptic action. It is given in the dose of five to ten milligrammes, in the place of creasote; its odor and taste are less disagreeable.

In tuberculosis it is administered in solution in alcohol and water, or in cod-liver oil (Sahli), in inhalations (Schuller), in pills (Horner), or in subcutaneous injections (Picot) with iodoform in solution in oil.

Benzosol, or *benzoated guaiacol*, is more antiseptic and less irritant than guaiacol, dissolving more slowly in the stomach. It is administered in wafers (five to ten grammes a day) in the same circumstances as guaiacol (Sahli).

Carboxylic guaiacol is but little used.

Guaiacol benzophenoid has been employed in ocular surgery; it is soluble in water, and does not stain the skin.

Styracol is solid, and may be employed in powder to dust wounds and ulcers. It is a good antiseptic.

Styrone, found in commerce crystallized or liquid, has a disagreeable odor, resembling hyacinth. It is little soluble in water, very soluble in alcohol. It is an energetic antiseptic, non-toxic, non-irritant, and has been employed in the treatment of otitis media.

SALOL AND GUAIACOLSALOL.

Salol ($C_{13}H_{10}O_3$) is an antiseptic more energetic than salicylic acid. It is the *salicylate of phenyl;* crystallizes in plates which melt at 42° C.; is insoluble in water, glycerin, and the heavy oils of petroleum; soluble in twenty-five times its weight of absolute alcohol, in ether, chloroform, benzene, turpentine, and the essential oils. Its flavor and its odor resemble those of essence of wintergreen.

In the organism, in presence of the pancreatic juice and alkaline liquids, it breaks up into phenic and salicylic acids, and acts by its two constituents. There are reports of poisoning following the lavish administration of salol, due to phenic acid set free in the stomach; such toxic accidents would not be likely to follow any ordinary dose.

Salol is employed internally in rheumatism; it

has antiseptic and analgesic properties. The following formula is a convenient one:

℞ Salol.......................... ʒ j–ij.
Mucilage....................... ℥ vj.

M. Sig.: A tablespoonful every two hours.

Externally, salol is employed in powder for the dressing of wounds. More active than boric acid, it is less so than iodoform.

Camphorated salol is a syrupy liquid which results from moderately heating together salol and camphor. It is employed in the same cases as camphorated phenol and camphorated naphthol; its antiseptic value gives it a rank between the two.

Guaiacolsalol ($C_{14}H_{12}O_4$) is an antiseptic superior to salol, as its chemical formula indicates, and might with advantage be introduced into the materia medica.

THYMOL.

Thymol ($C_{10}H_{14}O$), or *essence of thyme*, and *carvacrol* an isomer, are antiseptics superior to the cresols, and especially to the phenols. Thymol is obtained in large crystals, little soluble in water (1 to 1.50 per litre), soluble in alcohol and ether. It is much less toxic than phenic acid. Miquel classes it among the substances strongly antiseptic (equivalent, 2 grammes), between chloride of zinc and sulphate of nickel, but he considers it much less energetic than picric acid and very much less so than salicylic acid.

The figures given by Jalan de la Croix and those of Husmann place thymol before salicylic acid.

It must not be forgotten that if thymol ($C_{10}H_{14}O$) is more rich in hydrocarbons than salicylic acid ($C_7H_6O_3$), the latter is more rich in oxygen, and the researches of Rottenstein and Bourcart have taught us that the presence of a carboxyl group (COOH) much augments the antiseptic power of an oxybenzol or phenol. We believe then, till proof to the contrary is given, that Miquel is right, and that salicylic acid, salol, and guaiacolsalol are superior as antiseptics to thymol.

In practice, thymol presents certain disadvantages. It is quite irritant, very slowly soluble in water, and of high price.

It is chiefly in diarrhœa and dysentery that this medicament has been employed. In these affections the insolubility of the substance enables us to give it in large doses, and to obtain the disinfection of the intestine without fearing toxic effects due to absorption. It may be given in large doses—for instance, ten grains every two hours till sixty or ninety grains have been administered in the twenty-four hours.*

Thymol has been employed as a dentifrice, also

---

*[Dr. F. P. Henry (*Therapeutic Gazette*, 1888, p. 683) advises to give this medicament in pill form, dose 2½ grains every six hours. He thinks that the same good effects are obtained from the small as from the large doses.—TRANSLATOR.]

in gargles, and in the form of ointments in affections of the skin and in burns.

ARISTOL.

Aristol, or *thymol biniodide*, or *biniodide* of *dithymol*, is an amorphous powder of a reddish-brown color, insoluble in water and glycerin, little soluble in alcohol, but very soluble in ether, the vegetable oils, and vaselin. It decomposes under solar light, and should be kept in black bottles. Although it contains 46 per cent. of iodine, it is not absorbed by open wounds.

As its very complicated composition indicates, it is a very powerful antiseptic, and may be used in the place of iodoform, being inodorous and less toxic than the latter. It has been employed in affections of the skin and as a dressing to wounds and ulcers.

CAMPHORS AND ESSENCES.

In the same category as thymol (essence of thyme) may be placed a great number of aromatic compounds, many of which are employed as antiseptics under the name of essences. The essences are hydrocarbons of the formula $C_{10}H_{16}$, which is that of the essence of turpentine, and of camphene the essence of camphor. The camphors differ by the presence of oxygen, which approximates them to the alcohols and phenols.

Ordinary *camphor* ($C_{10}H_6O$), Japan camphor, or Laurus camphora, has long been employed in medicine. Its incontestable antiseptic properties, and the

faculty it possesses of dissolving the phenols and naphthols, have for many years given it a high place.

Camphor is easily reduced to fine powder by adding a few drops of alcohol while it is in the mortar. It is very slightly soluble in water, but dissolves readily in alcohol, ether, the oils, and acetic acid.

Camphor is a feeble antiseptic, but it is chiefly employed as an excipient or dissolvant of the phenols and naphthols, giving us *camphorated phenol, camphorated salol, camphorated naphthol.* Camphor in powder, and these divers substances, blend readily at a temperature of 40° C. (104° F.), and form oily liquids very useful for dressing bad wounds, for painting diphtheritic sore-throat, etc., the feebly antiseptic action of the camphor being singularly reinforced by the energetic antiseptics associated with it.

Equal parts of camphor and chloral blend together into an oily liquid, which has both analgesic and antiseptic properties. Other substances, blend with camphor to effect a similar solution,* in the following proportions: Pyrogallic acid, twenty-five parts; thymol, five parts; salol, ten parts; phenol, equal parts; and naphthol β and salicylic acid, one-half of one part. All these camphor compounds are easily incorporated with vaselin and other fatty bodies. They are soluble in alcohol and ether, but not in water.

---

*Desesquelle's table.

Borneol ($C_{10}H_{18}O$), or *Borneo camphor*, is, as indicated by its formula, a better antiseptic than ordinary camphor.

Essence of turpentine ($C_{10}H_{16}$) is, as its formula would suggest, a good antiseptic, useful in chronic diseases of the bronchi as an expectorant, and in advanced stages of typhoid fever (Geo. B. Wood). The dose in typhoid fever is 10 drops every two to four hours in syrup and mucilage. *Terpine* ($C_{10}H_{20}O_2$) is a derivative of turpentine.

Menthol, or *mint camphor*, is another good antiseptic of the same series. It is soluble in alcohol, ether, chloroform, etc. It has been chiefly employed as a topical agent, and in pulmonary catarrhs.

Oil of peppermint is a feeble antiseptic. It prevents the development of bacteria in solution of 1:50000, according to Koch.

Myrtol, or *essence of myrtle*, has been prescribed in chronic intestinal catarrhs (capsules, 2 to 3 grains).

Eucalyptol and *eugenol* are essences which are utilized as antiseptics in pulmonary and renal affections (in emulsion, in capsules, and in inhalations).

Eulyptol is a mixture of eucalyptol, salicylic acid, and phenol. It is a good antiseptic.

The essential oil of *cassia* (*Cassia fistula*) has been recently recommended as a good antiseptic (1:1000), in alcoholic solution or in emulsion in water.

RETINOL.

Retinol is the product of dry distillation of colo-

phene, which is itself the residue of the distillation of the turpentine of *Pinus pinaster*, having for formula $C_{44}H_{62}O_4$. Retinol is a liquid resembling olive oil and possessing a feeble pine odor.

It is an excellent antiseptic; is employed externally in its purity or as the excipient of a great number of medicaments. It dissolves salol (1:10), iodol (1:50), naphthol and aristol (1:50), camphor, cocaine, codeia, etc. When used as a solvent for resorcin, the latter must be first dissolved in glycerin. Retinol mixes with all the fatty bodies, sweet oil, vaselin, glycerin, etc.

It is not irritant, and does not change in the air.

Retinol has been employed pure in blennorrhagia, and more particularly in blennorrhagic vaginitis. For the latter purpose it is made to saturate a tampon, which is then introduced into the vagina and left there; it is not a painful application, and seems materially to abridge the duration of the disease.

In diseases of the skin, of the eyes, and of the ears, this body, which is easy to manage, may render important service both by its own action and as an excipient.

ANTISEPTIC MIXTURE OF SEVERAL ESSENCES.

Chamberland and Bouchard* have studied the antiseptic value of a certain number of vegetable es-

---

* Bouchard, "Therapeutique des Maladies Infectienses," p. 231.

sences. "There are some," says Bouchard, "which are as antiseptic as the mercurial salts. Six have no peer as antiseptics: these are the essences of origanum, China-canella, Ceylon-canella, angelica, vespetro, and Algiers geranium.

Bouchard has studied the antiseptic power of these essences, alone and combined, and finds the antiseptic equivalent high. It is well known that the ancient Egyptians employed various vegetable essences for embalming.

ACIDS OF THE AROMATIC SERIES.

These acids may be intercalated in the series of phenols which we have just been studying. They differ only by their acid function and the faculty of furnishing salts. They owe their properties to the carboxyl-group (COOH), which much augments, as we have said, the power of a component of this series. Most of them are powerful antiseptics; salicylic acid, for instance, is scarcely less so than salol, from which it differs by one CH_4 less.

We have already treated of tannic, thymic, and pyrogallic acids; we shall treat here of gallic, benzoic, salicylic, and oxynaphthoic acids.

GALLIC ACID AND GALLATES.

According to its formula, *gallic acid* is a more energetic microbicide than the trioxybenzols such as pyrogallic acid, from which it differs by the substitution of the group COOH for an equivalent of H. It

is crystalline, soluble in one hundred parts of cold water or three of boiling water, but is decomposed by exposure to the air, the solution becoming black. It is not much used.

Basic gallate of bismuth, or *dermatol*, is a saffron-yellow, inodorous powder which does not chauge in the air, is insoluble in water, alcohol, etc. It is neither irritant nor toxic. It is an excellent antiseptic, which may be substituted for iodoform in the dressing of wounds; it promotes cicatrization. It is given internally in the dose of 10 grains three times a day. It owes its properties in great part to its insolubility.

BENZOIC ACID AND THE BENZOATES.

Benzoic acid ($C_7H_6O_2$) is crystalline, little soluble in cold water, soluble in twelve parts of boiling water, and distills with the vapor of water. In the organism it is eliminated by the urine under the form of hippuric acid.

As an antiseptic it comes immediately after salicylic acid among the bodies strongly antiseptic (equivalent, 1.10 grammes, according to Miquel).

Several benzoates have been used as diuretics and antiseptics.

Benzoate of soda is soluble in water, and has been employed in the treatment of renal affections and in diphtheria. Its solubility makes it available for all cases where it is desired to administer benzoic acid internally.

Benzoate of bismuth is a white, insoluble powder which may be employed instead of iodoform. It has recently been proposed to substitute it for salicylate of bismuth for internal administration, especially when the kidney is diseased.

SALICYLIC ACID AND THE SALICYLATES.

Salicylic acid ($C_7H_6O_3$) is crystalline, little soluble in cold water (1:400), quite soluble in boiling water, very soluble in alcohol and ether. According to Miquel, it is of all the organic acids (with the exception of hydrocyanic acid) the most powerful antiseptic (equivalent, one gramme); and as it is feebly toxic (therapeutic equivalent, 40 centigrammes for one kilogramme, according to Bouchard), there is an indication for its employment whenever we wish to obtain an energetic antiseptic action without resorting to corrosive sublimate or the other inorganic compounds of the same nature. It is preferable to phenic acid, which has a disagreeable odor and a lower therapeutic equivalent (5 centigrammes).

Its action on the organism ought, at the same time, to be watched. It is eliminated very rapidly by the urine, and if the renal filter is altered (as in albuminuria) there may be toxic effects, even in the feeble dose of a gramme.

Under ordinary, normal circumstances, salicylic acid may be given in the dose of 4 to 6 grammes (ʒ j–jss) a day in acute rheumatism. It is better

to administer it in the form of salicylate of soda or lithia. Externally, it is employed as a powder or in alcoholic solution (2 per cent.).

Salicylate of methyl, or *essence of wintergreen* (obtained from the *Gaultheria procumbens*), is a substance from which chemists first obtained salicylic acid. This essence, which is much used as a perfume, is a good antiseptic, superior even to salicylic acid, from which it differs by one CH_3 more.

Salicylate of phenyl is *salol*, which has been considered above.

Salicylate of soda is given in doses amounting to sixty or even ninety grains a day in acute rheumatism, gout, etc. The presence of the sodium much lowers the bactericidal power of the compound. According to Miquel, this salt is but moderately antiseptic (equivalent, 10 grammes, *i.e.*, ten times as much as the pure salicylic acid). Salicylate of soda is very soluble in water.

Salicylate of lithia is, in Vulpian's estimation, superior to salicylate of soda in acute rheumatism.

Salicylate of bismuth is insoluble in water. It is much employed instead of the nitrate in intestinal antisepsis. A dose of five grains may be given with safety every two hours. It is given in typhoid fever, in putrid dyspepsias, in intestinal affections, etc., where the indication is to disinfect the alimentary canal. It has been used externally in eczematous affections, and in the intertrigo of infants.

Salicylate of quinine will be considered along with the salts of quinine.

OXYNAPHTHOIC ACID.

This acid ($C_{10}H_8O_3$) is said to be more antiseptic than salicylic acid, but it is very irritant. The alkaline solutions of the *alpha* acid are alone used; they destroy the *staphylococcus pyogenes* in two or three hours. This acid is but little soluble in water, but quite soluble in alkalies and in alcohol.

AROMATIC COMPOUNDS CONTAINING CO—COUMARINE.

The compounds of this group, designated under the names of *ketones*, *quinones*, etc., are but little used in medicine.

Coumarine, obtained from the Tonka bean, is an odorous essential oil, resembling by its properties benzoic acid, and insoluble in water. It is much used to mask the odor of iodoform, but its high price limits its usefulness. It is a good antiseptic, and may be used where benzoic acid does good.

AROMATIC COMPOUNDS OF THE GROUP NAPHTYL, OR NAPHTHOLS.

As we have said above, the naphthols or phenols containing the group *naphtyl* ($C_{10}H_7$) are the best antiseptics of this series. They are about as energetic again as the phenols of the phenyl group (C_6H_5), and are generally preferred to the phenols in therapeutics.

NAPHTHALINE.

Naphthaline ($C_{10}H_8$), a hydrocarbon derivative from benzene, is, like it, one of the products of the distillation of coal-tar. When pure, it is in the form of brilliant plates, fusible at 79° C., subliming at a little higher temperature, and distilling with the vapor of boiling water; insoluble in water, quite soluble in alcohol, very soluble in ether. It burns with a sooty flame.

Naphthaline is a good antiseptic, and has the advantage of being but little toxic. It has been employed with success in intestinal antisepsis, but physicians prefer to-day naphthol and betol. Its properties explain the good effects obtained in whooping-cough by the empirical treatment which consists in taking children affected by this disease to the gas-houses where the atmosphere of the rooms is saturated with naphthaline, and making them stay there a number of hours. Garnier proposes to substitute for this troublesome method, inhalations made at the patient's home and in the sick-room by means of bougies containing naphthaline—to be burned on a platter. It may also be employed under the form of spray mingled with vapor of water, owing to its ready sublimation at the temperature of boiling water.

NAPHTHOLS.

There exist two isomeric derivatives of naphthaline, which, under the names of naphthol alpha and

naphthol beta, have both the formula $C_{10}H_8O$ and are the phenols of naphthaline.

Naphthol alpha is crystalline, fusible at 94° C., almost insoluble in water (1:5000), soluble in alcohol and ether, glycerin, benzene, the oils, and boric water. It is a good antiseptic, superior to its isomer although less toxic. The latter is, however, thus far, the more used in therapeutics.

Naphthol beta crystallizes in brilliant plates, sometimes of a rose tint, fusible at 112° C., presenting the same solubility as its isomer. It is a powerful antiseptic, preferable to naphthaline, because it is without odor and does not cause, like the latter, disagreeable odorous eructations; it is, besides, less toxic, as the following table indicates:

	Naphthol B.	Naphthaline.
Antiseptic equivalent..................	0.40	1.51
Toxic equivalent	3.80	3.40
Therapeutic equivalent................	1.10	1.00

Naphthol is given internally in capsules to protect the mouth and gullet from its irritant action; the dose, in typhoid fever, is 5 grains every four hours. Twice and three times this quantity may be given without toxic effects. A good way to obtain intestinal antisepsis is to combine 5 grains of naphthol with 5 of salicylate of bismuth, which will just fill a large-sized capsule; six of these may be given in the twenty-four hours.

The alcoholic solution of naphthol (3 to 5 per

cent.), the naphthol oil, and the naphthol ointment, are used externally.

Camphorated Naphthol and Sulphoricinated Naphthol.—The preparations designated under this name are simple mixtures which facilitate the employment of naphthol, and not definite compounds. They are employed in the dressing of wounds, and especially in the treatment of diphtheria.

The two naphthols easily blend with camphor, as we have said above, and at a temperature of about 100° F.

Camphorated naphthol is an oily or syrupy liquid, used to swab or paint the diseased parts. It gives excellent results in diphtheria, but its application is painful. It may be advisable in children to paint the throat previously with a 2-per-cent. solution of cocaine. The camphorated naphthol may be combined with cocaine. This topical application has given results still more marked in buccal tuberculosis, in coryza and furunculosis (Fernet).

Sulphoricinated naphthol has the advantage over camphorated naphthol of being, in its application, almost painless, because the presence of sulphoricinic acid or sulphoricinate of soda prevents the caustic action of the naphthol. The formula is ten parts of naphthol to ninety of sulphoricinate of soda. It is a very thick, syrupy, or oily liquid, with almost no odor, and with a taste a little like that of castor oil; is very adherent to the skin and mucous membranes. Like

camphorated naphthol, it is painted over the diphtheritic false membranes. (See further on: *Sulphoricinic acid.*)

Betol and Benzonaphthol.—Betol is a salicylate of naphthol beta, obtained by the direct action of the two compounds; it is crystalline, white, inodorous, tasteless; insoluble in water. As its composition indicates, its antiseptic power should be superior to that of naphthol; it is less irritant than naphthol, especially to the digestive tube, and is given in the same doses as the latter (7½ grains in capsules).

Benzonaphthol, or benzoate of naphthol, may be substituted for the above with the special indications for benzoic acid and the benzoates.

Hydronaphthol ($C_{10}H_9O_2$) is the result of the oxidation of naphthol beta, from which it differs by the incorporation by the group OH. It is less soluble than naphthol, and is administered in smaller doses. The dose for internal use is two to five grains. For external use, a solution of alcohol and glycerin (one part hydronaphthol, nine of alcohol, and ninety of glycerin) is diluted with three-quarters as much water, and has very energetic parasiticide effects in the treatment of parasitic affections of the skin.

AROMATIC COMPOUNDS WITH SULPHUR AND IODINE.

In these organic compounds, the action of sul-

phur and sometimes of iodine is added to that of the hydrocarbon (phenol) to augment the antiseptic energy. We may designate especially aseptol, sozoiodol, sulphobenzoate of soda, ichthyol, thioresorcin, sulphoricinic acid, essence of mustard, etc., compounds which are not all well defined, and whose therapeutic action has not thus far been sufficiently studied.

ASEPTOL.

Sulphurous orthophenylic acid, or sozolic acid ($C_6H_5O.SO_3H$), introduced into therapeutics under the name of aseptol by Serrant, is obtained by the slow action of sulphuric on phenic acid. It is crystalline, deliquescent, soluble in all proportions in water, alcohol, and glycerin. It is more acid and less caustic than phenic acid, forming with bases crystallizable salts.

It is an energetic antiseptic, less toxic than phenic and salicylic acids (Serrant and Annesseux). Its antiseptic power is due especially to its property of saturating the ammoniacal bases. It is little used.

SOZOIODOL.

Sozoiodol, a compound containing both sulphur and iodine, has the formula $C_6H_4SO_4I_2$. It is an acid (iodoparaphenylsulphuric acid), and combines with soda and potash to form salts. It is an energetic bactericide, which it has been proposed to substitute for iodoform, as being less toxic and having a less disagreeable odor.

Solutions are employed of the free acid or of the salts of sodium or aluminium (2 or 3 per cent.); the sozoiodol of zinc is also used in powder or solution in glycerin, and there is a sozoiodol gauze, a sozoiodol cotton, and a sozoiodol of mercury. These preparations are still little used.

SULPHORICINIC ACID.

This acid is employed chiefly as a solvent and excipient, under the names of *mercurial solvent*, *sulpholeine*, *sulpholeic acid*, etc. It is obtained by the action of sulphuric acid on castor oil.

But it is the *sulphoricinate of soda* which is employed. This is a thick, transparent, deep yellow, syrupy liquid, having an oily feel, and very adherent to the skin. Its odor is almost *nil;* its savor, which is but little marked, resembles that of castor oil, but does not leave on the tongue any disagreeable or acrid sensation. It forms with water very stable whitish emulsions. It has been chiefly employed to dissolve a great number of antiseptics which are but little soluble in water, such as phenic acid, creasote and the cresols, salol and naphthol. These solutions are made with the aid of heat. They become transparent after remaining a certain time, except the naphthol solution, which continues turbid.

There is a popular mixture consisting of four parts of phenol, one of naphthol, one of creasote or salol, with six to nine of the sulphoricinate of soda,

which forms an excellent topical application, and when cold presents the consistence of an ointment; it is much employed in the treatment of diphtheria. Grancher highly recommends for this disease a 30-per-cent. solution of phenic acid in sulphoricinate of soda.

ICHTHYOL.

We designate under this name a sort of mineral tar obtained by distilling certain fossil rocks (Schistes) of the Austrian Tyrol, which contain a great quantity of the remains of fossilized fishes, presenting still the relics of bituminous organic matters with considerable sulphur (15 per cent.). Ichthyol is, then, a badly defined product, of which it is difficult to appreciate the value as an antiseptic.

The ichthyol of commerce is a blackish-brown syrupy liquid, which mixes with water, and is soluble in alcohol and ether containing a little benzol.

Prescribed at first by Unna in the treatment of diseases of the skin, this medicament has been vaunted by Freund as of great value in gynæcology, especially in the treatment of chronic metritis and salpingitis. This author prescribes it to be used internally in pill form, and externally for painting the parts and saturating the tampons (being dissolved or diluted in glycerin).

[It is recommended by Robert Bell as a resolvent in chronic affections of the ovaries, tubes, cellular tissue of the pelvis, and even in hæmatocele. A gly-

cerole of ichthyol, mixed with boric acid (10 per 100), is employed. A tampon saturated with this mixture is placed in the vagina, and may be kept there for three days. Schadewitsch lauds ichthyol in erysipelas. At first using it in collodion, he subsequently employed it in ointment with an equal quantity of lard spread upon the diseased area and a little beyond. On the face no covering was used; on the body, paraffine paper. A good formnla is: Ichthyol and sulphuric ether, of each, one part; collodion, two parts.]

THIORESORCIN.

This sulphuretted product of resorcin is of a pale yellow color, almost insoluble in water, little soluble in alcohol, but its salts dissolve well in water. It is an antiseptic little employed.

AROMATIC COMPOUNDS CONTAINING NO_2.

These compounds are all antiseptic, but more feebly than those containing the groups OH or COOH. We have, in fact, seen that nitrogen much diminishes the bactericide power which the two O's would have given to the substance. Moreover, the antiseptic power is in relation to the number of NO_2 groups which the substance contains; thus nitrobenzin ($C_6H_5NO_2$) is less antiseptic than picric acid ($C_6H_3O.3NO_2$).

NITROBENZENE, OR ESSENCE OF MIRBANE.

This compound ($C_6H_5NO_2$) is a yellowish liquid, with a sweet taste and the agreeable odor of bitter almonds, and is employed in perfumery. Miquel classes it among the substances *strongly* antiseptic (equivalent, 2.60 grammes); but it must be remembered that it is toxic, and this forbids its employment internally.

ESSENCE OF BITTER ALMONDS.

Under this name is designated a combination of benzoic aldehyde and hydrocyanic acid, which is used in medicine (especially under the forms of *distilled water* and *essential oil* of bitter almonds) both internally and externally. Its antiseptic power is less than that of essence of mirbane (equivalent, 3 grammes). It is equally toxic, and the dose of one to five centigrammes should not be exceeded of the purified oil, or one to ten grammes of the distilled water.

PICRIC ACID.

This acid ($C_6H_3O3NO_2$), called also *trinitrophenol*, possesses an acid and bitter taste, is little soluble in cold water, soluble in alcohol and ether. It crystallizes in lemon-yellow needles, detonates under heat, and its salts (picrates) also detonate. As an antiseptic it is inferior to benzoic acid (its equivalent is 1.30 grammes, according to Miquel), and it is little used.

SULPHAMINOL.

This body is a yellow, inodorous, insoluble powder, which has been used instead of iodoform. It is a poor medicament, hardly deserving a place in the materia medica.

ESSENCE OF MUSTARD.

This essence is the *sulphocyanate of allyl* (C_3H_5-CSN). It has been prescribed by Koch as a powerful antiseptic, killing bacilli and their spores when it is in the state of vapor. If you put a drop of this essence into the bottom of a bell-jar which covers a culture of cholera bacilli, these will not develop, and will all be killed in the course of twenty-four hours (Babes). Its antiseptic power is inferior to that of benzoic acid (Jalan de la Croix).

ACETANILID; ASEPTIN; EXALGIN.

Acetanilid (C_8H_9NO), or antifebrin, and *exalgin*, or methylacetanilid, should also be regarded as antiseptics.

Aseptin, or monobromacetanilid, is an energetic bactericide.

Aseptinic acid is liquid, soluble in water, and, according to Linde, is a non-toxic antiseptic superior to iodoform. A 5-per-cent. solution is used for the dressing of wounds and for the preparation of an aseptic gauze.

§ 3.—ALKALOIDS.

We shall treat here of antipyrine and quinine, which interest us from the point of view of antisepsis. Remember that many of these compounds seem to be derived from a basic nucleus called pyridine (C_5H_5N).

ANTIPYRINE, OR ANALGESIN.

This body which is designated under the name dioxymethylquinizine ($C_{11}H_{12}N_2$) of the chemists, is chiefly employed in medicine as an analgesic and antipyretic. Its antiseptic properties are incontestable, and have recently been set forth by Visbecq as the result of experiments at the School of Lyons. Antipyrine presents the remarkable peculiarity of acting chiefly on the *toxines* secreted by the vegetal microbes. It has no action in malarial fevers. Vianna, prompted by laboratory experiments, has recently recommended it as an antiseptic to oppose the diphtheria bacillus. It is very soluble in water.

QUININE.

Quinine ($C_{20}H_{24}N_2O_2$) is the active principle of cinchona. Its salts are especially employed in medicine to combat malarial fevers, but are also of value in other affections of an intermittent nature.

We now know that malaria is caused by the presence in the blood of a micro-organism which is not a bacterium, but a protozoön of the class Sporozoa, and of the group Coccidia. Although the salts

of quinine are almost exclusively employed to combat this parasite, it is probable that many other antiseptics among those which we have previously studied would succeed equally well in the treatment of malarial fever. But decisive experiments to this effect are still lacking.

Per contra, we know with certainty that the preparations of quinine are also bactericides of a certain value. According to Miquel, the *hydrobromate* of quinine is to be classed among the substances *moderately* antiseptic (equivalent, 5.50 grammes). According to Marcus and Pinet, quinine chloride in the dose of seven or eight grains opposes the development of the bacteria of putrefaction, while in the dose of 4.50 grammes only it arrests their proliferation. Quinine probably has more action on the protozoa, but we have not yet any precise experiments to determine this, for the reason that the micro-organism of malaria has not been cultivated.

According to what we now know of the antiseptic action of the various acids, the *salicylate* of quinine ought to be the most effective, by reason of the high equivalent of the salicylic acid. This salt is soluble in 900 parts of water. The basic salicylate contains 68 per cent. of quinine; the neutral salicylate 54 per cent.

Basic *bromhydrate* of quinine is soluble in sixty parts of water and contains 85 per cent. of quinine; the neutral salt is soluble in seven parts of water, and

contains 75 per cent. quinine. After the salicylate, this is probably the most active of the salts of quinine considered from an antiseptic point of view.

Basic *quinine chloride*, soluble in twenty-five parts of water, contains 83.6 per cent. of the alkaloid, and is, according to Dujardin-Beaumetz, more active than the sulphate.

Basic *sulphate* of quinine is but little soluble in water; it contains 74.3 per cent. of quinine.

The *neutral sulphate* is much more soluble, but contains only 59.12 per cent. of quinine. This is the salt in common use, and is easily obtained by acidifying, with a few drops of dilute sulphuric acid, watery emulsions containing the basic sulphate (the sulphate of commerce).

CINCHONINE, ANTISEPTOL.

The salts of cinchonine are succedanea of the salts of quinine, but have a more feeble action. I shall mention only *antiseptol*, or *iodosulphate of cinchonine*, which is an impalpable powder of a reddish-brown color, like kermes, inodorous, insoluble in water, soluble in chloroform and alcohol. It may be prepared extemporaneously by pouring a solution of ioduretted iodide of potassium into a solution of sulphate of cinchonine, washing, then drying the precipitate.

This antiseptic powder might replace iodoform, and would be quite as active; it contains 50 per cent. of iodine. There is need for a comparative study of antiseptol and the aristols.

RÉSUMÉ AND CONCLUSIONS—CRITICAL APPRECIATION OF THE RELATIVE VALUE OF THE ANTISEPTICS.

After having passed rapidly in review the numerous antiseptics which the therapeutic arsenal furnishes us, it is necessary to know how to make a proper choice among these medicaments. Each may present its advantages according to the indications of the disease and the particular properties of the antiseptic (solubility or insolubility, etc.).

For external antisepsis, the dressing of wounds and of natural cavities, corrosive sublimate and the other mercurial preparations occupy and will probably long keep the first rank. Near to corrosive sublimate we may place nitrate of silver, generally preferred for the treatment of diseases of the eyes. Phenic acid, after having long had a great popularity, is probably going more and more out of use. Next to the bichloride, iodoform is, of all antiseptics, the most used for the dressing of wounds and suppurating surfaces, and is an excellent medicament with hardly anything against it but its odor. Reserving iodoform for the gravest cases, the physician may in most cases substitute for it iodol, aristol, dermatol, antiseptol, and especially salol, which gives excellent results when we wish to obtain union by first intention. Creasote may, lastly, render service in the dressing of bad wounds.

For local antisepsis, notably of the mouth and throat, the bichloride should only be employed with the utmost caution. It is better to make use of bromol, of camphorated naphthol, or *sulphoricinated naphthol*, which seems to be really the most valuable medicine for the treatment of infectious and pseudo-membranous anginas.

The antisepsis of the intestinal canal in the dyspepsias, the enterites, and in typhoid fever, is sufficiently obtained by the aid of such antiseptics as are insoluble or little soluble, as naphthol, betol, and benzonaphthol, associated or not with salicylate of bismuth.

General or internal antisepsis is less advanced than local antisepsis. Salol, more powerful than salicylic acid, has been advantageously employed in rheumatism and analogous affections. Acetanilid acts in the same manner, but is a more feeble antiseptic. The salts of quinine (sulphate, bromhydrate, salicylate) are more suitable for malarial affections. Naphthol and betol have also a general action, beside their local action on tbe digestive tube, and present the advantage of being little toxic; thus 1000 grammes of living matter can support 13 centigrammes of naphthol alpha, which will sterilize 1084 grammes (Bouchard).

Hypodermatic or parenchymatous injections of antiseptic substances are still but little employed, although they are likely to have importance in the

future. At the same time, creasote in subcutaneous injections has given quite remarkable results in the treatment of tuberculosis. This medicament probably owes its curative effects to the property which it possesses of being eliminated, under a gaseous form, by the lungs, rather than to any really specific action on the bacillus of tuberculosis.

The essences, which are powerful antiseptics, have not yet in clinical practice proved to be as useful as we might have expected.

A word about the mixtures of several antiseptic substances, mixtures which, conformably to the law of Bouchard, *do not augment their toxic power, while increasing their antiseptic power.*—We have already seen the advantages which have been derived from sulphoricinated naphthol; it is by artifices of this kind that the employment of certain antiseptics will be rendered more and more practical.

To sum up: The simple antiseptics borrowed from mineral chemistry, or the mixed antiseptics such as iodoform, answer very well for external or local antisepsis. The complex antiseptics, borrowed from organic chemistry, are, on the contrary, much more suitable for internal antisepsis; we have seen that these compounds are but little toxic, and the more antiseptic (as a general rule) the more complex their molecule. It is to this very complication that they owe their property of being, like naphthol, "more deleterious to the vegetal parasite cell than to the

animal cell" (Bouchard). It is among these compounds of the aromatic series, and especially among the essences, that we must look for new antiseptics such as will enable us to realize general antisepsis without danger to the organism.

APPENDIX.

Note A.—Table of Jalan de la Croix, indicating the doses of antiseptics which neutralize the action of pathogenic bacteria.

[The figures represent the number of milligrammes employed to prevent the development of the bacteria, and to sterilize a litre of meat-juice serving as a culture-medium for the bacteria.]

PURE ANTISEPTICS.	DOSES		DOSES		DOSES	
	Which prevent.	Which do not prevent.	Which arrest.	Which do not arrest.	Which sterilize.	Which do not sterilize.
Corrosive sublimate......	40	20	170	154	80	66
Chlorine..................	33	24	44	33	2320	2170
Chloride of lime..........	90	76	268	224	5880	3875
Sulphurous acid.........	155	117	500	200	5265	3660
Sulphuric acid....... ...	170	120	500	300	8620	4900
Bromides	155	126	392	250	2975	1820
Iodides..................	200	150	646	500	2440	1916
Acetate of alumina......	235	184	2350	1200	15620	10870
Essence of mustard . ..	300	175	1690	1220	35700	25000
Benzoic acid............	350	250	2440	1960	8265	4760
Boro-salicylate of soda...	350	264	15890	9090	33300	20000
Boric acid...............	500	330	1000	700	6660	5000
Thymol..................	145	450	9175	4715	50000	27780
Salicylic acid...........	1000	893	18660	12820	....	28570
Permanganate of potash	1000	700	6660	5000	6600	5000
Phenic acid.............	1500	1000	45550	23810	376000	250000
Chloroform	11100	8930	8930	7460	. ...	1250000
Borax....................	15140	12990	20830	14500	....	83350
Alcohol	47620	28570	227300	166600	....	847000
Essence of eucalyptus...	71400	50000	8700	4800	....	171500

Note B.—Miquel's Table, indicating the smallest quantity of antiseptic substance necessary to prevent the putrefaction of a litre of beef bouillon neutralized, then exposed to the air.

In the substances eminently antiseptic are found the salts of mercury and silver; these constitute this group. It is understood that the figures which correspond to each one of these medicaments represent the minimum quantity capable of preventing the putrefaction of a litre of broth:

Biniodide of mercury	25	milligrammes.
Iodide of silver	30	"
Oxygenated water	50	"
Nitrate of silver	80	"
Bichloride of mercury	70	"

The second group comprises certain substances very powerfully antiseptic. They are as follows:

Osmic acid	15	centigrammes.
Chromic acid	20	"
Chlorine	25	"
Iodine	25	"
Chloride of gold	25	"
Bichloride of platinum	30	"
Hydrocyanic acid	40	"
Iodide of cadmium	50	"
Bromine	60	"
Iodoform	70	"
Chloride of copper	70	"
Chloroform	80	"
Cupric sulphate	90	

Group 3: Substances powerfully antiseptic:

Salicylic acid	1.	gramme.
Benzoic acid	1.10	"
Cyanide of potassium	1.20	"
Bichromate of potassium	1.20	"
Picric acid	1.30	"

Ammonia	1.40	grammes.
Zinc chloride	1.90	"
Essence of mirbane	2.60	"
Sulphuric acid, Nitric acid, Hydrochloric acid, Phosphoric acid,	2 to 3.	"
Essence of bitter almond	3.	"
Phenic acid	3.20	"
Permanganate of potash	3.50	"
Alum	4.50	"
Tannin	4.80	"
Oxalic acid, Tartaric acid, Citric acid,	3 to 5.	"
Sulphide of potassium	5.	"

Group 4: Substances moderately antiseptic:

Bromhydrate of quinine	3.50	grammes.
Arsenious acid	6.	"
Sulphate of strychnine	7.	"
Boric acid	7.50	"
Hydrate of chloral	9.30	"
Salicylate of sodium	10.00	"
Sulphate of protoxide of iron	11.00	"

In the fifth group (feebly antiseptic) we note:

Calcium chloride	40	grammes.
Sulphuric ether	22	"
Hydrochlorate of morphine	75	"
Ethyl alcohol	95	"
Borax	70	"

In the sixth and last group (very feebly antiseptic) we find:

Iodide of potassium	140	grammes.
Chloride of sodium	165	"
Glycerin	225	"
Bromide of potassium	240	"
Hyposulphite of sodium	275	"
Chloride of ammonium	115	"
Sulphite of ammonium	250	"

ANTISEPTIC THERAPEUTICS.

BY

DR. E. L. TROUESSART,

PARIS, FRANCE.

TRANSLATED BY E. P. HURD, M.D.

VOLUME II.

1893.
GEORGE S. DAVIS,
DETROIT, MICH.

TABLE OF CONTENTS.

CHAPTER V.

PAGE

Antiseptic Treatment of Diseases of the Locomotor Apparatus and of the Nervous System.

CHAPTER VI.

The Antiseptic Treatment of General Infectious Diseases.

CHAPTER VII.

Antiseptic Treatment of Diseases of the Skin.

CHAPTER VIII.

The Antiseptic Treatment of Diseases of the Eye.

ANTISEPTIC THERAPEUTICS.

PART II.

ANTISEPTIC TREATMENT OF DISEASES WHICH BELONG TO INTERNAL PATHOLOGY.

PLAN AND DIVISION.

In this Second Part it is my intention to indicate, in connection with the consideration of each disease in particular, the methods of treatment and formulæ which belong to the antiseptic therapeutics of these diseases. Passing lightly over therapeutic procedures to-day abandoned, or which seem to give only uncertain results, I shall attempt to give the methods that yield the best results, and particularly such as are preferred by our best authorities in the hospitals of Paris and actually employed in their daily practice.

I hardly need say that the antiseptic treatment should be supplemented, according to the indications, by eusthenic or hypnotic remedies, conformably to the division of medicaments into three great classes which I have previously indicated. As a general rule, I shall consider here only the antiseptic treatment properly so-called.

I shall study the diseases in the following order:

1. Respiratory apparatus (mouth, pharynx, larynx, bronchial tubes, lungs, pleura).
2. Digestive apparatus (stomach, intestine, liver, peritoneum).
3. Circulatory apparatus (pericardium, endocardium, myocardium, blood-vessels).
4. Genito-urinary apparatus of man and of woman.
5. Locomotor apparatus and nervous system.
6. General diseases.
7. Diseases of the skin.

Although it does not enter into the plan of this work to treat of surgical antisepsis, I shall indicate briefly the principal antiseptic modes of treatment applicable to the following conditions:

8. Diseases of the eyes.
9. Diseases of the nose, throat, and ears.
10. Antisepsis in obstetrics and gynæcology.

CHAPTER I.

ANTISEPTIC TREATMENT OF DISEASES OF THE RESPIRATORY APPARATUS.

STOMATITES.

Stomatitis is generally considered as belonging to diseases of the digestive apparatus; but antisepsis of the mouth is of so great importance from the point of view of diseases of the respiratory apparatus (angina, laryngitis, bronchitis, pneumonia), and these are so often complicated with stomatitis, that it seems best to place the treatment of the latter at the very beginning of this study.

It is a fact that a great variety of microbes live in greater or less abundance in the mouths of individuals who enjoy the most perfect health.* In 1883, Rasmussen enumerated thirteen species in the saliva of healthy men; several (leptothrix, penicillium, mucor) are not true bacteria, but belong to the lower fungi. M. Vignal, in 1886, demonstrated for the first time pathogenic microbes, such as those of pus (*Staphylococcus pyogenes aureus*) and of pneumonia, etc. In a word, the saliva is liable to contain specimens of all the pathogenic microbes, from those of diphtheria to those of typhoid fever.†

---

*Th. David: Les Microbes de la Bouche. Paris, 1890.

†See on this subject a résumé by M. Netter in the *Revue d'Hygiene*, 1889, p. 501.

To this list, already long, must be added the microbes of dental caries; for details concerning these and the diseases produced by them we must refer the reader to the monograph of M. David above indicated.

The prophylaxis of these conditions will be considered in Part III (Antiseptic Hygiene). Here we have to do only with the question of stomatitis properly so-called.

Concerning the etiological diagnosis of these stomatites, it is first of all important to know whether the saliva is acid or alkaline, because on this the indications for the choice of the antiseptic depend. Mixed saliva (formed by a mixture of the fluids furnished by the three pairs of glands) is normally *slightly alkaline*. When it remains long in the mouth, as is the case in most febrile diseases, or where the patient is badly nourished, the saliva may undergo ammoniacal decomposition. On the other hand, it becomes acid when it contains an excess of epithelial cells (Gautier).

Moreover, it is known that the lower fungi (*Saccharomyces albicans*) are developed in an acid medium; bacteria, on the contrary, or microbes properly so-called, can only thrive in an alkaline medium. The treatment should therefore be very different according as the stomatitis is caused by the thrush fungus or by bacteria. In the first case alkaline waters are indicated; in the second, acids are required.

It is always easy to test the alkalinity of the saliva by litmus paper, making a comparative experiment with saliva considered as normal. In case of doubt, microscopic examination of the saliva of the patient may be made.

Thrush (*Mugnet*).—Affection produced, as we have just seen, by the *Saccharomyces albicans*, and which is always accompanied by an abundant desquamation of epithelium. The saliva is acid.

Vichy water, which is slightly alkaline, suffices in mild cases, employed as a gargle and beverage. In grave cases, use for a collutorium a saturated solution of borax. G. Sée recommends the employment of boric acid, as in the following formula:

Boric acid........................	1 part.
Glycerin..................	5 parts.

M. Paint the aphthous parts with this solution.

Boric acid is a very feeble acid, reddening litmus but very slightly. Its use in this affection is sanctioned by experience.

Vidal recommends Van Swieten's solution of corrosive sublimate applied with a camel's-hair pencil to the diseased parts. It is a very effective remedy.

In all cases of stomatitis, good results are obtained by irrigations every two hours with a solution of peroxide of hydrogen—a remedy which, as we shall see, is also used to advantage in diphtheria.

Stomatites Symptomatic of Grave Fevers.—In typhoid fever and other fevers of long duration,

accompanied by a fuliginous state of the mouth, gums and teeth, the following collutorium (*British Medical Journal*) will be beneficial:

Boric acid	1.00
Chlorate of potash	0.75
Lemon-juice	15.00
Glycerin	10.00

M.

Aphthous Stomatitis.—This affection is attributed to the agency of the same microbe that produces the *epizoötic aphthous fever* of the bovine species, a bacterium described under the name of *Streptococcus aphthicola.*

M. Hirtz, while admitting the microbian nature of the affection, has treated it by painting the mouth and throat every two hours with salicylate of soda in 20-per-cent. solution; the excessive pain of the ulcerous period being assuaged by interposing between the gingival and buccal mucous membranes little wads of absorbent cotton saturated with the following solution:

℞	Sod. salicyl	1 part.
	Cocaini chloridi	2 parts.
	Aquæ destil	100 parts.

Intestinal antisepsis is effected by the following preparation administered by mouth in cachets or capsules:

Salicyl. of bismuth	āā 2 Gm.
Naphthol	

M. Divide into four powders. Sig.: One powder to be taken every six hours.

Ulcero-Membranous Stomatitis. — M. Bergeron, who has shown that this affection is specific, endemic, and contagious, considers chlorate of potash the most effective remedy. This may be used in gargles or sprays, in saturated solution.

Jaccoud combines the chlorate of potash with a decoction of cinchona:

Chlorate of potash	6.0
Alcoholature of cochlearia	30.0
Syr. cinchona	60.0
Decoc. cinchona	250.0

M. For a gargle.

The application of dry chloride of lime, of sulphate of zinc (1 part to 20 of water), of sulphate of copper (1 part to 40), is recommended in rebellious cases by Henoch, and irrigations of permanganate of potash and salicylic acid in dilute solution are employed by the same authority when the affection takes on a necrotic form. In the simply ulcerous form, Comby recommends a solution of borax in honey of roses and glycerin for a collutorium:

℞ Borax (or potas. chlor.)	1 part.
Mel. rosae, Glycerin — ää	5 parts.

Barié advises the following formula:

Salicyl. acid	1 part.
Glycerin	10 parts.

To paint the ulcerations.

Mercurial Stomatitis.—Suspend the mercurial

treatment and give chlorate of potash, or use the following dentifrice as an astringent antiseptic:

℞	Tannin	2.0
	Alum............................	1.0
	Spts. menth...............	q. s.
	Pulv. catechu Yellow cinch. bark } ää	15.0

In the severer cases, Ricord orders light brushings of the gums with hydrochloric acid in more or less dilute solution.

Finally, however paradoxical it may appear, corrosive sublimate as a mouth-wash succeeds very well, according to the following formula (of Rienzi Errico):

℞	Corrosive sublimate.............	0.25
	Distilled water............... ..	1000.00

M. To be used as a collutorium during forty-eight hours.

The fetor of the breath disappears rapidly, and the inflammatory symptoms subside, so that a cure is effected in about five days.

GANGRENE OF THE MOUTH, OR NOMA.

This affection (caused by the *Streptococcus nomæ*, Trévisan, according to Cornil and Babes) must be treated by the most energetic antisepsis. Cauterization with the thermo-cautery, which destroys the microbian focus, is to-day preferred. A thick paste of camphor is spread over the sore. After the fall of the

eschar, Henoch applies a wad of cotton saturated with camphorated wine. Sulphoricinated naphthol may be employed. Irrigations with salicylic or thymic acid in aqueous solution are of service.

AMYGDALITES AND NON-DIPHTHERITIC ANGINAS.

The infectious and contagious microbian nature of amygdalitis (tonsillar angina) and of most of the simple anginas, is generally admitted. Alternations of weather, formerly considered as exclusive causes of these diseases, are probably only determining causes, influencing the microbes which exist in the mouth (or their germs) in the same way as the succession of the seasons acts on the seeds buried in the earth—that is to say, by giving them the stimulus which renews their activity, and by creating at the same time, in the organism, the *morbid opportunity.* The hygrometric condition of the air must have a great influence upon the development of the bacteria of the mouth and throat, for the sensibility of micro-organisms to variations of humidity has been long known.

We have noticed recently in Paris (February and March, 1892) that dry, cold, east winds, raising clouds of dust, were coincident with real epidemics of amygdalitis and of laryngitis, which were, on the whole, generally benign. The microbian nature of these affections does not exclude their cyclical evolution, which is ordinarily effected through the re-

sources of the organism alone. Nevertheless, a simple angina may become very rapidly and insidiously severe by a local extension of the parasite and of the inflammatory processes that it produces, when the antiseptic treatment has not been pursued from the onset.

The microbes, probably of multiple species, which may develop in amygdalitis have not yet been fully studied. In a case of phlegmonous amygdalitis, M. Bouchard found the pus coming from the abscess filled with an enormous quantity of short and thin bacilli. M. Hanot has noted the *Streptococcus septopyæmicus* (Biondi) in a severe angina complicated with purulent pleurisy.

In other cases the affection may rapidly take on the form of a general infection, with chills, intense fever, engorgement of the sub-maxillary glands, urine red, turbid and albuminous, pseudo-rheumatic arthropathies, etc., or be complicated with œdema of the throat.

Simple Amygdalitis.—For a simple amygdalitis, Bouchard prescribes the following gargle:

℞	Sodium borate	6.0
	Tinct. benzoin....................	10.0
	Infus. of blackberry root..........	250.0

Or:

Boric acid....................	2.0 to 4.0
Mulberry syrup..................	50.0
Distilled water..................	100.0

M. To use full strength for painting the throat, or mixed with equal parts of warm boiled water for a gargle every two hours.

Charles Eloy* has recommended the following formulæ. For the local treatment, apply the following with a swab:

℞ Salol.................................. 2.0
Alcohol.................q. s. to dissolve.
Glycerin.............................. 40.0

Or, better still, the sulphoricinate of salol, which stays on the affected parts longer:

℞ Salol .... 5.0 to 10.0
Sulphoricinate of sodium........... 90.0

M. To be applied by means of a swab or camel's-hair pencil. (It has the consistence of a pomade.)

For a gargle, salicylic acid (1 part to 300 parts water), naphtholated water, creolinated water, may be used:

Commercial creolin } āā equal parts.
Warm water }

This is to be applied with a swab, and followed by a gargle of warm water to relieve the burning sensation produced by the creolin.

For irrigation, salol-water made when required by adding to a litre of warm boiled water the following solution:

℞ Salol.............................. 1.0
Alcohol............... .... 50.0

Salol, which is but little toxic, suits children well.

**Revue de Clinique et de Thérapeutique, et Moniteur Thérapeutique*, Jan. 4, 1892, p. 3 *et seq.*

M. Leon David* has prescribed lately, in the treatment of various forms of angina, *microcidine* (*naphtholate of soda*), which is very slightly toxic, and has the advantage over most of the preceding applications of being soluble in water without the addition of alcohol (solution of 8 parts to 1000, which may be weakened by the addition of warm water; when required, solutions much stronger may be used, as 3 parts to 1000).

Painting the throat with tincture of iodine, or with glycerin and iodine, is less painful, and may be indicated to cut short the disease.

IODIZED GLYCERIN.

℞	Iodine	0.25 to 0.50
	Potas. iodide	3.00
	Glycerin	25.00 to 30.00

M. If the application is painful, it may be diluted by doubling the quantity of glycerin.

For general treatment, M. Gougenheim gives *salol* (2 to 4 grammes in four to eight capsules), to be taken during the day as calmative and febrifuge. M. Dubousquet Laborderie prescribes quinine and resorcin; M. Bouchard, *naphthol* as a general antiseptic. In severe cases a treatment similar to that of diphtheria may be carried out.

Herpetic Amygdalitis.—This affection should be

* Thèse, 1892, and *Journal de Médecine et de Chirurgie Pratiques*, 1832, p. 264.

considered as no less infectious than the above, and the antiseptic treatment is the more necessary since tonsillar abscess is sometimes a complication.

PSEUDO-MEMBRANOUS DIPHTHEROID ANGINAS.— These anginas, which only differ from diphtheritic anginas by their relative benignity, have been considered as attenuated forms of diphtheria. It is more probable that they are due to a different microbe, which causes the formation of false membranes similar in appearance to the true diphtheritic exudate. The less virulent nature of the toxines secreted explains the relative benignity of these affections, but the local antiseptic treatment of diphtheritic angina should be applied with equal care, particularly in the case of children, where the local symptoms have so great importance.

One of these anginas, at least (*Pneumococcus angina*), has been studied quite thoroughly.

ANGINAS DUE TO THE PNEUMOCOCCUS.—We use the plural of angina because, according to M. Netter, the *Klebsiella salivaris* Trévisan, or Talamon-Fränkel microbe, designated by the common name of pneumococcus,* and considered as the specific microbe of fibrinous pneumonia, may produce the four following forms of angina: (1) Suppurative amygdalitis; (2) Pseudo-membranous angina; (3) Follicular amygdalitis; (4) Simple and herpetic angina.†

* In French we use the word *Pneumococcus* or the systematic name of *Klebsiella salivaris*.

† *Semaine Médicale*, May 13, 1891, p. 195.

Pseudo-membranous angina due to the pneumococcus is the most important, because of its clinical resemblance to diphtheritic angina, and because of its gravity, especially in children. It was described by Jaccoud in 1891. The false membranes contain only the pneumococcus, with no mixture of Löffler's bacillus. In a case observed by M. Netter in a child of three years, the extension of the false membranes to the larynx necessitated tracheotomy.

I have myself observed a severe angina of this nature in a child of seven years who had had pneumonia *three months* before.

The antiseptic treatment is like that of diphtheria: the applications with camphorated or sulphoricinated naphthol, etc., and especially the irrigations with boric water renewed every two hours, give excellent results.

The fact that these anginas often succeed pneumonia indicates the necessity of careful antisepsis of the mouth during the duration of the latter disease and for a long time after.

DIPHTHERITIC ANGINA: CROUP.

This affection, caused, as is known, by Löffler's bacillus (*Pacinia Löffleri*, Trévisan), and designated under the name of croup when the false membranes are propagated to the larynx, derives its gravity from the obstruction caused by the exudate in the air-passages, especially in young children who have the

larynx and trachea very narrow; the empoisonment of the blood by the toxines proper to this microbian species is also an important factor of gravity.

It is, then, necessary to act from the very onset by a local energetic treatment to destroy in the pharynx the false membranes which contain the specific bacillus, the treatment having much fewer chances of success when the affection is propagated to the trachea or there are symptoms of general poisoning.

Mercurials always occupy the front rank among antiseptics designed to combat the gravest maladies. Corrosve sublimate administered internally and locally, and calomel, are still prescribed by English and American physicians. Frictions of mercurial ointment over the neck, to the point of salivation, have been also employed. Cyanide of mercury has been vaunted by Erichsen, Annuschet, and more recently by Ruelle, who gives the following formula:

Cyanide of mercury................	0.05
Alcohol............................	8.00
Distilled water.....................	192.00

M. Dose, a teaspoonful every hour, before the disease becomes generalized.

But these very active medicaments are but little used in France, by reason of their toxic action, which is to be dreaded in children.

Iodoform in solution in ether or tolu balsam may be painted over the diphtheritic patches, or insufflations of iodoform powder mixed with sugar may be employed.

Iodide of potassium has been prescribed for internal use in a 2- to 4-per-cent. solution in water, by Stepp; dose, one or two teaspoonfuls every hour. [This treatment can surely do no good.]

Bromine, under the form of bromine water, has been advised by Ozanam.

M. Sevestre prescribes:

Bromine	gtt. iv.
Bromide of potassium	0.50 Gm.
Syrup	30.00
Distilled water	125.00

M. Sig.: A teaspoonful every hour.

It would be advantageous to use bromoform, and especially bromol, of which I have already spoken (see Part I). Bromol dissolved in glycerin (1 part to 25) may be used as a local application to the false membranes, in the place of iodine and iodoform.

Sulphur has been employed in insufflations (the dried powder being blown upon the diseased parts). This is a favorite mode of treatment with Liebermeister. Barboza applies sulphur in emulsion in oil of sweet almonds. Sulphide-of-calcium pills (1/8 grain every hour) are also prescribed by the same authority. The calcium sulphide is decomposed, and H_2S is set free and impregnates the breath.

In nasal diphtheria, Jules Simon prescribes the application of sulphur ointment, 1 part sulphur to 8 of lard.

The perchloride of iron has long had a great

reputation in diphtheria; it is used internally, and locally in paintings or swabbings of the throat. The patches in the mouth or throat are brushed two to four times a day with a solution of perchloride of iron and glycerin, of each equal parts. [The tincture of the perchloride is given internally in the dose of five to ten drops every two hours.]

Boric acid in concentrated solution (2- to 4-per-cent.), in glycerin and water or in plain water, is very much employed in irrigations by reason of its absolute innocuousness. It is preferred to lime-water, formerly employed for purposes of irrigation.

Forain extols chloride of zinc in saturated solution, mixed with about an equal amount by weight of powdered cinchona bark, and the whole made up into a paste of the consistence of jelly by stirring in strained honey. This mixture is brushed over the false membranes every two to four hours. He claims that the application is attended with little pain, and that if used from the onset it arrests the development of the disease.

The antiseptics borrowed from organic chemistry are generally preferred to-day in France in the local treatment of diphtheria. Lactic and oxalic acids, chloral, carbolic acid associated or not with camphor, copaiba, resorcin, salicylic acid, creasote, naphtha, etc., have all in turn been tried.

Jules Simon, an excellent hospital authority,

employs salicylic acid according to the following formula:

Acid, salicylic	1.00
Alcohol	q. s. to dissolve.
Glycerin	0.40
Infus. eucalyptus	0.60

M.

(It will be seen that the above is a very concentrated solution of salicylic acid.) To be applied to the diphtheritic patches by means of a swab consisting of a stick armed with absorbent cotton; should be brushed over the parts with considerable force (but *not to cause lesions*) every hour during the day, and three times during the night.

Simon also uses lemon-juice and dilute acetic acid in the same manner, sometimes alternating them with the salicylic acid.

Bergeron employs a weaker solution of salicylic acid, as follows:

Acid, salicylic	1 part.
Glycerin	30 parts.

Phenol and camphorated naphthol, which have rendered good service in the past, have been of late rather set aside for sulphoricinated phenol and naphthol. The first-mentioned topical agents are open to the objection of being somewhat painful when employed in rather concentrated solution. Gaucher,

nevertheless, still employs the following mixture, claiming for its use the most satisfactory results:

℞	Camphor....................	20 parts.
	Castor oil	15 parts.
	Alcohol	10 parts.
	Phenic acid (concentrated)......	5 parts.
	Tartaric acid..................	1 part.
M.		

His method of applying this remedy is as follows: A swab is made by wrapping a wad of absorbent cotton around the end of a pair of long dressing-forceps; this is dipped into the mixture and brushed freely over the diphtheritic patches. To remove the false membranes half detached, Gaucher uses the swan-skin brushes of M. de Crésantigues.

In the preceding formula naphthol may be substituted for the phenic acid in the same proportion; the camphorated naphthol may also be employed (1 part to 2 of camphor, dissolved in glycerin), the back part of the throat having been previously painted with a 2-per-cent. solution of cocaine.

Comby prescribes the following formula:

℞	Naphthol.......................	1 part.
	Camphor................	2 parts.
	Glycerin	3 parts.

M. To be applied with sufficient thoroughness three times a day by meaus of an ordinary swab.

To this treatment he adds sprays, for five to ten minutes at a time, of boric solution 4-per-cent., or a salicylic solution 2-per-cent.

Phenol and sulphoricinated naphthol are the two antiseptics which seem to have been preferred for cauterization of the diphtheritic membranes, because of their relative innocuousness, and chiefly because their application is comparatively painless, which is a consideration in treating children.

Sulphoricinated phenol, or Yvon's sulphoricinate of orthophenol, is used by MM. Grancher, Hutinel, Sevestre, d'Heilly, Legroux, and others, according to the following formula, more or less modified:

℞ Sulphoricinate of soda........... 70 parts.
Phenic acid (pure)............... 30 parts.

M. Dissolve while cold, shaking it.

Even without the water this mixture is not caustic; the proportion of phenol may be increased to 40 per cent. Use the forceps—swab, the points being covered with antiseptic cotton. The mucous membrane becomes pale under this application; it is well to be forewarned of this fact, in order not to confound this condition with a false membrane.

If naphthol be preferred, the following formula may be used:

℞ Sulphoricinate of soda........... 90 parts.
Naphthol β..................... 10 parts.

Mix cold or slightly warm.

Salol and creasote can be used equally well as excipients of the sulphoricinate of soda. M. Munk uses creolin, which has the advantage of being soluble in water (1 to 2 per cent.).

Creasote with rum or with glycerin is given internally by M. Legroux, in the secondary affections (bronchitis and broncho-pneumonia) which may complicate diphtheritic angina. To this is added the hydrochloric lemonade (4 to 1000) in order to lessen the action of the toxines secreted by the diphtheritic microbe.

M. Sevestre, in addition to the local treatment, performs intestinal and general antisepsis by giving betol, or rather benzonaphthol.* Moreover, the benzoate of soda (two to five grammes a day as a potion) is given to insure the working of the kidneys, which is all-important in eliminating the poisons.†

Critical Appreciation.—Among the numerous formulæ above reviewed, a choice must be made. This is a plan that may be safely followed:

1. To cauterize the false membranes, choose phenol or sulphoricinated naphthol. In applying these remedies great care must be taken to avoid abrading the subjacent mucosa.

2. Irrigations have even as great an importance as cauterizations. They should be more frequent (every two hours); on them we depend for the detachment of the false membranes. The liquid with which the irrigations are made is of less importance: boiled water, boric water, lime-water, peroxide of hydrogen,

---

* Betol is the salicylate of naphthol. Benzonaphthol is the benzoate of naphthol.

† *Sem. Méd.*, Dec. 2, 1891, p. 230.

salicylated water (1 part to 1000), chloral water (1 per cent.), generally warm, may be used with equal success. These irrigations may be made less frequently during the night, out of regard to the patient's sleep; the respiratory bruit is a sufficient guide—if this becomes noisy and stertorous, an irrigation will make the breathing more easy for an hour or two.

If there are false membranes in the nares, they should also be irrigated. Where the physician cannot always be present, and where there are rebellious children, as frequently happens, the parents should be made to understand the usefulness—even the absolute necessity—of the irrigations and of their frequent renewal. The kind of irrigator matters little; a simple hand-ball rubber syringe or a fountain syringe will answer the purpose, provided a sufficient jet is obtained. If necessary, and if the child refuses to open his mouth, a wedge may be placed between his teeth. It is superfluous to add that all the instruments should be made perfectly aseptic (the cannula of the irrigator should remain in a solution of sublimate, 1 to 1000, all the time it is not being used). If there is any danger of extension to the larynx, the irrigating substances may be used as sprays.

3. To make the atmosphere of the room aseptic, creasote may be used in spray and in evaporating solutions, or solutions of thymol and the essence of eucalyptus, of tar, and of other essences, may be employed in the same way.

4. Intestinal and general antisepsis may be obtained by means of betol or benzonaphthol, and if necessary, inhalations of oxygen, independently of the ventilation of the room—which should be kept at 16° or 17° C. (60° to 65° F.) The patient should be fed as much as his appetite will permit, and his strength should be kept up with tonics (wine of cinchona, etc.). Finally, the renal and circulatory functions should be regulated with benzoate of soda and with caffeine.

LARYNGITIS.

The antiseptic treatment of laryngitis has made very little progress because of the difficulty of applying local treatment. Sprays of antiseptic liquids do not reach the seat of disease completely in croup or in the other laryngeal infectious diseases.

In typhoid laryngitis, M. Renaut has used with success corrosive sublimate (Van Swieten's solution) sprayed into the wide-open mouth for ten minutes, three or four times a day. Recovery ensued in five or six days.

In tuberculous laryngitis, M. Ruault has had good success with sprays charged with the vapors of phenic acid or resorcin. Carbolic sprays of 1 to 2 : 100 act slowly, but are better borne than sprays of greater strength. Solutions of resorcin in doses varying with the gravity of the disease, do not provoke any irritation, but on the other hand produce a notable amelioration.

Creasote dissolved in oil is used for swabbing by MM. Cadier and Ruault.

Rosenberg uses an oily solution of menthol which is both anæsthetic and antiseptic.

Sprays and inhalations of sulphurous waters are very useful in tuberculous and syphilitic laryngites. In the latter case, M. Ruault uses nitrate of silver, 5 to 10 per cent., which is well borne.

Most of the antiseptics that we have named as applicable in the treatment of angina may be employed as sprays in laryngitis.

M. Tissier gives the following indications for the antiseptic treatment of chronic laryngites (non-tuberculous) with or without curetting:

In epithelial lesions, camphorated naphthol gives the best results, used according to the following well known formula:

℞ Naphthol β .... 1 part.
Camphor .... 2 parts.

Mix and triturate together.

This is applied by means of a laryngeal probe covered with cotton, with the help of a laryngeal mirror—the cotton tampon should be sufficiently large to brush over the entire mucous membrane. It provokes a slightly smarting sensation, which however is not painful. These applications should be renewed twice each week. Towards the end a solution of zinc chloride, 1 part to 10, may be substituted.

Camphorated salol is less efficacious than naphthol, but is indicated sometimes in subacute laryngitis:

℞	Salol	3.0
	Camphor	2.0

Triturate and filter the liquid mixture.

In the most severe cases, scraping or curetting the diseased tissues is of use.

I think that sulphoricinated naphthol might be used here in place of camphorated naphthol.

Internally, especially in the treatment of croup, the good effects of benzoate of soda are marked. Its uses in the treatment of bronchitis we shall study in the proper place.

BRONCHITIS.

In the bronchial secretions of patients suffering from bronchitis, numerous species of bacteria are generally found, presenting themselves almost always under the form of *microbian associations;* that is to say, it is difficult to decide if the morbid process has been provoked by one more than another. The kinds most frequently found are: *Streptococcus pyogenes*, *Staphylococcus aureus*, *Klebsiella Friedländeri*, *Protei*, and mycogenous bacteria of which little is yet known, etc. The streptococci, notably, penetrate quite deeply into the folds of the connective tissue of the bronchi affected with necrobiosis, the protective epithelium of which is desquamated; this tissue is infil-

trated with leucocytes (phagocytes). In chronic bronchitis the epithelium is often preserved, but modified (Cornil and Babes).

The greater part of the medicaments employed as *expectorants* or *modifiers* of the bronchial secretions are, at the same time, antiseptics. Such are the balsams of Tolu and of Peru, terpine, terpinol, terebinthine, creasote, eucalyptus, iodine and iodides, etc.

M. Ruault recommends very highly benzoate of soda in all forms of bronchitis, from coryza and colds to catarrhal bronchitis, acute and chronic. Below are his conclusions:

1. The benzoate of soda appears to have an elective action upon the mucous membranes of the upper passages, similar to that which other balsams, such as terpine, have upon the mucous membranes of the bronchi, and as terebinth and the balsam of copaiba have upon the mucous membranes of the urinary passages.

2. Its use is indicated preëminently in common cold, coryza, the simple anginas, and in congestive attacks allied to granular pharyngitis.

3. It must be used in the adult in doses *per diem* of from four to five grammes at least, often six to eight grammes, given during six to twelve consecutive days.

4. The physician will avoid the prolonged use of this medicament, without intervals of suspension, in order to prevent digestive troubles, especially in dyspeptics.

At the onset of a coryza or a simple cold, M. Ruault gives three or four times per day a soupspoonful of the following syrup in a cup of an infusion of pine-buds:

Benzoate of soda*....................	40.0
Dissolved in:	
Water.............	80.0
Add:	
Syrup of bitter orange peel..........	280.0

Shake.

Under the influence of this treatment recovery frequently follows in three to five days.

Terpine is often prescribed as a modifier of the bronchial secretions. Below is the formula given by M. Dujardin-Beaumetz:

POTION.

Terpine..............................	0.50
Syrup of catechu....................	30.00
Alcohol.............................	30.00
Water...............................	100.00

(To be taken in tablespoonful doses during the day.)

Or, if preferred, terpine and benzoate of soda may be combined, as in the following formula:

POTION.

Terpine............................	0.50
Benzoate of soda...............	1.00 to 3.00
Syrup of Tolu } ää................	25.00
Syrup of acacia }	
Distilled water......................	100.00

(Dose, a tablespoonful every hour.)

---

* The benzoate should be prepared with benzoic acid extracted from benzoin.

(In this potion terpine is simply in suspension in the liquid.)

Terpinol is prescribed generally in capsules of 10 centigrammes, or in pills as in the following formula:

Terpinol / Benzoate of soda	ää	0.10
Sugar		q. s.

(For one pill. Take from six to twelve per day.)

Turpentine and creasote are used in potions or in capsules, and are especially efficacious in catarrhal and chronic bronchites.

M. Dujardin-Beaumetz prescribes the following wine:

Beechwood creasote	3.00
Alcohol	100.00
Wine of Bagnols	300.00
Simple syrup	100.00

(To be taken in spoonful doses.)

Or, again, the mixture:

Vegetable creasote	3.00
Neutral glycerin	400.00

(Take one to two tablespoonfuls, morning and night, in a glass of water suitably sweetened.)

Capsules containing equal parts of creasote, turpentine, and balsam of Tolu, in such a manner that each capsule represents *one gramme* of the mixture, have given me good results in all cases where the bronchitis was unduly prolonged and tended to pass

from the acute to the chronic state. The muco-purulent secretion is rapidly dried up; moreover, these capsules taken at the moment of eating (four to six per day) are well supported by the stomach, and do not cause disagreeable eructations.

In *fetid bronchitis*, M. Lancereaux employs the hyposulphite of soda in doses of four to five grammes in a potion to be taken during the day. The favorable action is not evident before a week or more.

In *broncho-pneumonia* complicated with other diseases, especially in the child, M. Sevestre has obtained good results from calomel.

LA GRIPPE, OR INFLUENZA.

The bacillus of influenza, already noted and photographed by Cornil and Babes in 1890, has recently been described in a more complete manner by Pfeiffer and Canon (of Berlin). It is a very small, rod-shaped organism, often grouped in chains, end to end. Stained by methylene blue, it has the appearance of a diplococcus, as is seen in the photographs of Babes,* and its method of grouping end to end has caused it often to be mistaken for a streptococcus (whence the name of *Streptococcus Seiferti*, given by Trévisan to this bacterium). This micro-organism should be classed in the group *Bacillus*, and placed near the

* Cornil and Babes, "Les Bacteries," 3d ed., t. ii, pl. iv, fig. 6.

Bacillus insidiosus (Trévisan) or the *Bacillus murisepticus* (Fluegge), under the name of *Bacillus Seiferti.*

A great number of antiseptic treatments have been proposed to combat this affection, and it may be said that all the substances in the arsenal of therapeutics have been tried in turn.

Sulphate of quinine, antipyrine, the acetate and muriate of ammonia, salol, betol, exalgin, acetanilid, phenacetin, naphthol, etc., are the principal medicaments used.

M. Dujardin-Beaumetz employs, according to the indications, in the nervous form, antipyrine (cephalalgia) or exalgin (rachialgia).

Antipyrine is administered in some alcoholic potion or in tea (two to three grammes per day).

Exalgin is given in the following potion:

Exalgin	2.50
Spirits of mint	10.00
Dill-water	120.00
Syrup of orange flowers	30.00

(A soupspoonful, morning and evening.)

Phenacetin is given in capsules containing one gramme, morning and evening (it is less active than exalgin).

In the catarrhal form, the same authority prescribes:

Muriate of quinine	0.25
Antipyrine	1.00

(For one capsule. Give two per day, one morning and evening.)

The strength of the patient may be sustained by the use of hypodermatic injections of caffeine dissolved in boiled water to which benzoate of soda has been added (2 grammes of each to 6 grammes of water).

English physicians have recommended a potion composed as follows:

Salicylic acid	....	7.50
Ammonium carb., q.s. to neutralize.		
Glycerin	....	30.00
Bromide of ammonium	ää	7.50
Muriate of ammonium		
Benzoate of ammonium		
Liq. ammoniæ acetatis	....	60.00
Peppermint water......q.s. to make		180.00

(To be taken by soupspoonfuls every two hours in warm milk or water till defervescence takes place.)

Benzol is recommended by M. W. Robertson (of Newcastle-on-Tyne).

In grave cases intestinal and general antisepsis must be sought by aid of naphthol, betol, or benzonapthol.

WHOOPING-COUGH.

Although the contagious and infectious nature of this affection is generally admitted, the microbe which produces it, probably the bacillus discovered by Affanassjew in 1887 (*Bacillus Affanassieffi*, Trévisan; *B. tussis convulsivæ*, Affanassjew), has not yet been sufficiently studied.

Phenic acid has been recommended from the first for this disease. Ortille places before the mouth, at the moment of the sibilant inspiration which follows the paroxsyms, a wide-mouthed bottle containing a phenic solution. A plate filled with a mixture of phenic acid, petroleum, and benzoin is placed in the sick-room.

Sprays have also been used with a 2-per-cent. phenic solution, three times per day, the cannula being kept at a distance of about three inches from the mouth (Gerhardt and Burchardt). The strength of the solution has even been increased to 4 and 5 per cent. (Goldschmit), in the endeavor to keep the patient in an atmosphere strongly charged with carbolic acid.

Phenic acid has also been introduced by the alimentary canal (Oltramare):

POTION.

Phenic acid........................	1.0
Syrup of mint........................	40.0
Water........................	80.0

Petroleum, in inhalations from plates, is advised by Hildebrandt.

The muriate, the tannate, and the sulphate of quinine in insufflations or sprays, sometimes associated with ammonium carbonate, have been tried by various physicians.

Benzoate of soda in potion (6 grammes) has been given as in croup (Tordeus).

Thymol is employed by M. Poulet and M. Bouchut, who use the following mixture by evaporation:

Thymol	10.0
Alcohol	250.0
Water	750.0

Salicylic acid, the salicylate of soda, and resorcin have been used as topical agents, being applied as deeply as possible, and turpentine has been employed in inhalations and vaporizations.

Kolover has obtained some success in injecting to the base of the pharynx a solution composed of:

Sulphate of quinine	4.0
Sulphuric acid	2.0
Distilled water	190.0

The patient's tongue is depressed, and he is made to pronounce the letter A while the liquid is injected by means of a syringe, at first every two hours, then every three hours when the paroxysms diminish in frequency.

Insufflations of powders into the nose have been employed by Michael (quinine, benzoin, boric and salicylic acids, iodoform, tannin, associated with more or less inert powders—sugar, talc, marble-dust, etc.).

M. Guerder uses finely-ground coffee thoroughly dried, and mixed with boric acid. M. Moizard employs the following powder:

Pulverized benzoin, Salicylate of bismuth, ää	5.0
Sulphate of quinine	1.0

The antispasmodic treatment still prevails in the hospitals of Paris; with bromides and preparations of belladonna and valerian are associated the tincture of Drosera and the fluid extract of *Grindelia robusta*, given in doses of one or more drops. The latter, which is a resin, probably has a certain antiseptic action.

M. F. Garnier has recently called attention again to the old popular or empirical custom of making children pass an hour or two in gas factories. This practice was renounced because the atmosphere of these rooms contains a toxic gas (ammonium sulphide) mixed with the phenic acid and the principles of tar to which the therapeutic effects are due, and also because children often contracted there broncho-pneumonia.

Having remarked that naphthaline is the active principle of tar, M. Garnier proposes to effect inhalations at the homes of patients by burning on a plate troches formed of naphthaline and powdered charcoal, to which is added a small quantity of potassium nitrate to facilitate combustion.

In accordance with this theory, it might also be advisable to make a trial of naphthol in swabbing or sprays (as in laryngitis), and to give it internally.

Antipyrine may also render service in the treatment of whooping-cough.

PNEUMONIA.

Fibrinous pneumonia is caused by the presence in the pulmonary vesicles of the pneumococcus of Fränkel and Talamon, which does not differ from the lanceolate microbe of the saliva (Pasteur), *Diplococcus pneumoniæ* (Fränkel), or *Streptococcus lanceolatus Pasteuri* (Gamaleïa). It is the *Klebsiella salivaris* of Trévisan. At the period of suppuration the *Streptococcus pyogenes* and the other microbes of pus are found in the sputa.

M. Charrin explains the cyclic evolution of pneumonia on the theory that in this disease it is an accidental vaccination which is produced in the lung. The termination depends upon the intensity of the living virus, and the resistance of the organism, which protects itself by aid of the phagocyte cells of the pulmonary vesicles. If the inoculation has been too intense and is complicated with suppuration, death may follow. Otherwise the recovery takes place as soon as the epithelial cells of the pulmonary vesicles and the organism itself undergo vaccination, for the presence of pneumococci in the sputa persists for a long time after recovery (Charrin).

If this vaccination of the entire organism is a reality, and if the cyclic evolution of the pneumonia is not limited simply to the short life of the microbe and to its sensibility to an elevated temperature, it is certain that the vaccinal influence is not of long duration, since we have seen pneumococcus anginas supervene

three months, or sometimes only a few days, after the defervescence of the disease. It seems more logical, in every case, to admit a purely local vaccination. According to Tchistovitch, the favorable termination should be in proportion to the abundance of the pulmonary phagocytosis.

However this may be, the microbian nature of pneumonia being admitted, its antiseptic treatment is indicated in the most formal manner, not only at the period of suppuration, but from the onset of the disease. This treatment, however, has advanced very little, apart from the requirements of antiseptic hygiene which preoccupy the physician in all severe affections much more than formerly. In the hospitals of Paris the treatment called expectorant (kermès, etc.), the eusthenic treatment (caffeine, etc.), and the revulsive treatment (cups, blistering, etc.) still are regarded as fulfilling the indications of the malady.

The treatment by alcohol (Todd's potion), which was much in vogue fifteen or twenty years ago, appears to be abandoned, or reserved for particular cases.

It does not seem possible, in this disease, to act upon the microbian element by inhalations or sprays, although oxygen may render aid when asphyxia is threatened. Attempts have been made to cause the antiseptic to penetrate as far even as the parenchyma of the lungs.

M. Lépine (of Lyons) is much occupied with this question. Relying on the innocuousness of intra-

pulmonary injections, when they are made with a solution properly diluted, he injects, by means of Pravaz's long-needle syringe, inserted two to three centimeters in depth through an intercostal space so as to penetrate to the centre of the hepatized region, solutions of benzoate of soda, iodide of potassium, and corrosive sublimate (1 : 40000). New researches are necessary, however, before this process can become general in practice.

Finally, in pneumonia the physician will not neglect to make use of general antisepsis by the aid of naphthol, betol, and benzonaphthol. Preparations of creasote may also be tried, which succeed in bronchitis, broncho-pneumonia, and tuberculosis by diminishing the purulent secretion, which constitutes one of the principal dangers in pneumonia.

PULMONARY TUBERCULOSIS.

This affection, caused by the *Bacillus tuberculosis* (Koch), is one of the most difficult to cure because of its evolution, ordinarily slow and insidious, and the localization of the tubercles in the parenchyma of the lungs (connective tissue). A correct diagnosis is of great importance from the onset of the disease, before the patient becomes enfeebled and the lesions have attained a great extent: thus, in cases where auscultation does not give complete certainty, it is indispensable to proceed to microscopical examination of the sputa, which will remove all doubt by revealing the presence of the specific bacillus and warrant instant recourse to energetic treatment.

A great number of antiseptics have been proposed or tried for tuberculosis. Let us pass rapidly over the treatments actually abandoned, or rarely used, and study those now considered the most efficacious. with strychnine (one milligramme per dose of the oil.)

Iodine and the iodides were formerly given in phthisis (Trousseau, Pidoux, Piorry). Cod-liver oil, which is still employed to a large extent, owes its effects in great measure to the iodine which it contains (it also contains chlorine, bromine, and phosphorus), so that it must not be considered simply as a sparing aliment (*aliment d' épargne*), being at once very digestible, furnishing respiratory materials, and acting as a reconstituent of histological elements.

However this may be, M. Jaccoud estimates that this medicament is not effective except in large doses—100, 200, and even 300 grammes per day when supported well by the patient; for this purpose it is associated with brandy, rum, kirch-wasser, ether, or with strychnine (one milligramme per dose of the oil).

For the fever, M. Jaccoud gives salicylic acid in doses of 2 grammes the first day, diminishing on the succeeding days (1.50 grammes, then 1 gramme), resuming at need the primary dose. When the patient is obliged to take doses very near together, the fol lowing potion is prescribed:

Salicylic acid..........................	2.0
Salicylate of soda....................	5.0
Rum or cognac	50.0
Distilled water	5.0
Aromatic wine.........................	120.0

If this mixture is poorly supported, hypodermatic injections may be given of a solution containing equal parts of water and salicylate of soda.

Iodoform, alone or associated with creasote (to which we will return later), is administered by M. Legroux according to one of the following formulas:

Iodoform, Terpine, ää	3.00
Turpentine	2.00
Marshmallow powder	1.50
Benzoic acid	2.00
Magnesia	1.50

(For sixty pills. Four to ten per day.)

Creasote, Iodoform, Terpine, ää	5.0
Benzoic acid, Larch turpentine, ää	2.0
Marshmallow powder, Magnesia, ää	6.0

(For 100 pills. Four to ten per day.)

This formula may be varied by excluding terpine.

Inhalations of hydrofluoric acid, employed by M. Herard, are effected by conducting into a closed chamber air which has circulated in a gutta-percha vessel half-filled with the following solution:

Hydrofluoric acid	150.0
Water	300.0

The air is set in motion by bellows worked by the foot. After passing through the solution, and being

charged with hydrofluoric vapor, it is purified in a wash-bottle from the small remaining portions of sulphuric acid and hydrogen sulphide. The patient remains in the chamber one hour, and the air charged with acid is renewed every fifteen minutes.

Aërotherapy is one of the simplest and best treatments of pulmonary tuberculosis. As soon as those affected with the disease are able to leave home they are sent to pass the winter in regions where the climate is but slightly variable and the mean temperature allows almost constant life in the open air (Madeira, Algiers, Nice, Menton, Hyères, Cannes, etc.), or in elevated localities where the air is frequently renewed and is of great purity (Falkenstein and Gobersdorf, in the Alps). There is an establishment for fresh-air cure at Vernet, France, under the direction of Dr. Sabourin.—When it is not desirable to move the patient, aërotherapy is still possible at home.

M. Debove has recently tried in his practice the *treatment by open windows*, and has obtained good results. Patients placed in rooms with wide-open windows have well supported the severe cold of the late winters, the part of the room occupied by the patient being so sheltered as to avoid the extreme cold, yet receive the benefit of constant ventilation and fresh supplies of pure air.

M. Tapret, at the hospital of Saint-Antoine, uses air compressed and charged with the vapors of crea-

sote. The metallic bell invented by Paul Bert for his experiments in anæsthesia is used for this treatment. The patients remain in this bell four hours. Compression is slowly carried on by means of a pump, of which the air passes across shavings saturated with creasote. On an average, this air contains one milligramme of creasote per litre. At the end of half an hour the pressure reaches an atmosphere and a half; at this point it is maintained for three hours, then for the space of half an hour it is slowly relaxed. The patient inhales in this manner about four grammes of creasote. The treatment is renewed every day. Improvement is marked after several sittings; it is very evident at the end of several months.

Let us content ourselves with merely indicating other processes less used, notably injection of gases by the rectum—hydrogen sulphide, sulphide of carbon, and carbonic acid (Bergeron)—and the treatment by phosphates and phosphorated oil, which acts primarily upon nutrition, like cod-liver oil, and which may be employed together with the antiseptic treatment.

Tannin gives good results in pulmonary tuberculosis. MM. Raimond and Arthaud, who have made particular use of tannin, speak of it as follows:

"Tannin, administered in doses of one to five grammes per day, possesses an efficacy much superior to that of either iodoform or sulphide of carbon, especially in the treatment of the various acute forms. In almost all patients we have seen the cough from

the first day become less frequent, the expectoration less abundant, the night sweats arrested, the general enfeeblement lessened, and at the end of a fortnight we have generally observed in all patients with not too extensive lesions or absolute obstacles to nutrition a slight augmentation of weight, which continued during the entire period of the treatment."

I myself have had occasion to employ tannin, and I have noted that it was well supported, even when its use was continued for several months, and that it had a favorable influence on the bronchial secretion. It is given in capsules, to be taken before eating.

Creasote, however, occupies the highest rank in the treatment of pulmonary tuberculosis.

According to experiments made by Coze and Simon at Nancy in 1884, by injecting under the skin of guinea-pigs bacilliferous sputa which had been mixed for forty-eight hours with some antiseptic substance, creasote alone arrests the development of the *Bacillus tuberculosis.* Other antiseptics tried in the same manner (corrosive sublimate, eucalyptol, hydrogen, sulphur, helenine, thymol) have given no results.

MM. Bouchard and Gimbert, in 1877, again called attention to the creasote treatment by insisting on the use of beechwood creasote obtained by distilling the tar from this tree. Given in large doses (as high as 3.60 grammes), creasote effects, in favorable cases, a diminution of ex-

pectoration and of the cough, an amelioration of the physical signs and consequently a reduction of the fever and a revival of the strength; later it suppresses the night sweats, arrests the emaciation, and promotes appetite and return of flesh.

Creasote may be administered by the stomach. The following is the formula used by M. Dujardin-Beaumetz:

Beech-tar creasote..................	3.0
Alcohol	100.0
Common syrup......................	100.0
Wine of Bagnols...................	300.0

A tablespoonful morning and evening in a glass of sweetened water.

To this is joined the use of a phosphorated wine, the formula of which is as follows:

Phosphate of soda.....	6.0
Phosphate of potash................	3.0
Syrup of bitter oranges	60.0
Wine of Bagnols....................	200.0

A wineglass at each meal as a tonic to the stomach.

Creasote mixed with oil may also be used:

Cod-liver oil.......................	150.0
Pure creasote of wood-tar........	1.0 to 2.0

Or the following pills:

Pure creasote of beech-tar } ää........	4.0
Iodoform }	
Liquorice powder........	6.0
Honey	q. s.

(For eighty pills. Take eight per day.)

M. Bouchard employs the following wine of creasote:

Pure creasote of wood-tar	13.50
Tincture of gentian	20.0
Alcohol of Montpellier	250.0
Malaga wine . . . . q. s. for 1 litre.	

(Two to four tablespoonfuls every twenty-four hours, to be taken in a glass of water to avoid the irritating action of the creasote.)

M. Bouchard also injects creasote into the cellular tissue. For this purpose he dissolves the medicament in oil, which, while not irritating the tissues, permits of gradual absorption. He has even increased by concentration the strength of the solution to 50 per 100 without producing local accidents.—The dose of 25 centigrammes of creasote per kilogramme of weight of the body may be attained with no signs of intoxication, while the dose of 70 centigrammes per kilogramme would be fatal.—In general, only about three grammes of creasote per day are given, although, according to the preceding figures, this dose may be increased to 15 grammes. This injection must be introduced with great slowness.

M. Burlureaux, in his practice at the Military Hospital of Val-de-Grace, has employed upon a great number of patients subcutaneous injections of creasote, and has perfected the technique of these injections, using the apparatus of Gimbert (of Cannes) modified so as to render it more practical. This apparatus is designed for slow injection.

The apparatus of MM. Burlureaux and Guerder, constructed by M. Lamy, has two models. No. 1 is a flask of 300 c. c. with three tubulures, two above, one below, closed by rubber stoppers. To the upper part are adapted the air-tube and the manometer; to the lower, the tube for injection provided with a stop-cock. The air, forced by a hand rubber ball, does not enter the flask until it has passed through the wadding filter. The injection tube has an aluminium tip to which a hollow needle of platinum or gold is affixed. The flask is so graduated that each division represents 5 grammes of oil. The apparatus No. 2 does not differ from the first except in its more perfect and complicated construction: the hand-ball is replaced by an air-pump.

After assuring himself of the cleanliness of the apparatus, and sterilizing the needle, the operator fills the flask about two-thirds full and recorks it carefully; air is forced into it by pressure on the hand-ball, and the stop-cock with which the air-tube is provided is then closed. A second introduction of air is then made, which is generally sufficient—watch being kept upon the manometer. The oil is seen to rise in the manometer: when its level has attained the point D, the pressure is sufficient. The stop-cock of the injection tube is then opened to make sure that the needle is not plugged and that the liquid flows slowly, that is, about forty drops per minute—which represents 20 grammes per hour. The operator then proceeds with the injection.

After the skin is washed with an antiseptic solution the needle is plunged deeply into the cellular tissue, and the stop-cock is opened; the liquid begins to flow immediately. During the first five minutes it is well to keep watch in order to insure against accident (puncture of a vein, etc.)—which is very rare (once in 10,000 times). The physician may then leave the patient alone, or a nurse may keep watch over the manometer to see that the pressure is always maintained at the same level. When the prescribed dose has been injected, the stop-cock is closed and the pressure of air is lowered; the needle is then withdrawn, and a plug of absorbent cotton is pressed over the puncture for some minutes. It is the custom generally to prescribe rest after the injection; but certain patients have received progressively from 10 to 150 grammes (increasing 10 grammes per day) after coming a long distance, returning immediately afterwards. The average dose is 50 grammes of oil per day; the maximum dose has been 200 or 220 grammes at one sitting, which represents 14 grammes of creasote.

The liquid injected is composed of rectified creasote, perfectly free from phenic acid, and mixed with oil of sweet almonds or olive oil washed in alcohol, in the proportion of one gramme of creasote to 14 grammes of oil. The injection is but slightly painful because made slowly (from two hours and a half to eight and nine hours, according to the dose). In

the insertion of the needle, preference is given to the gluteal region, the thighs, or even the back. The patient, either reclining or seated upright, may read, eat, and in fact busy himself with almost any occupation which requires but little movement, while the injection is in progress.*

M. Pigot (of Bordeaux), on the ground that guaiacol is considered the active principle of creasote, and relying on the researches of Sahli and Fræntzel, employs guaiacol associated with iodoform. He gives it in capsules containing 5 centigrammes of guaiacol and one to three centigrammes of iodoform—two, four, or six capsules per day, after meals. This treatment is well supported and always ameliorates the state of the patient, the chances of success being the greater the sooner the treatment is begun.

M. Picot also uses a mixture of guaiacol and iodoform dissolved in sterilized olive oil for injections into the supra-spinous fossa (5 centigrammes of guaiacol and 1 centigramme of iodoform per cubic centimeter of the solution). The results have been of the best, especially in tuberculous pleurisy.

M. A. Weill (of the Rothschild Hospital, Paris) has employed the following mixture for hypodermatic injections:

Pure guaiacol......................	2.0
Oil of vaselin......................	100.0

---

*For further details upon this subject, see the *Journal de Médecine et de Chirurgie Pratiques*, t. lxii (1892), p. 49, art. 15020.

These injections were made in the abdomen or thigh. The absorption is very rapid; the patients feel the effects of the guaiacol within a few seconds after the injection. The amelioration is generally very evident, at least in tuberculous patients where the disease has not progressed too far. In fact, several have appeared to be cured.

Very recently M. E. Main has undertaken in the Cochin Hospital, in the service of M. Dujardin-Beaumetz, a series of comparative researches to ascertain if it is expedient to substitute guaiacol or any other of its components for creasote.* According to experiments made on animals, the author establishes the gradation of toxicity of the elements of creasote in the following order, the first on the list being the most toxic:

1. Paracresylol.
2. Phlorol.
3. Guaiacol.
4. Creasote (officinal).
5. Creosol.

The toxicity of all these bodies is feeble, and creosol is not therapeutically more active than creasote. The conclusion of the author is that creasote is preferable, as it is easier to use and less toxic than guaiacol.

---

* *Bulletin Général de Thérapeutique*, March 15, 1892, p. 305 (Thèse de Paris, 1892).

C. Kohos, however, has just proposed a new mixture for hypodermatic injections, composed of creolin* and cod-liver oil, according to the following formula:

Cod-liver oil	100.0
Jeyes' creolin	2.0
Sulphuric ether	1.0

One to five cubic centimetres of this solution are injected every day into the supra-spinous fossa. This treatment has been giving good results.

Still it is creasote itself, in solution in sterilized oil, which must be considered the best antiseptic for the hypodermatic treatment of pulmonary tuberculosis; and, according to the expression of M. Dujardin-Beaumetz, the treatment of this disease may be summed up in two words: "Hygiene and creasote."

PLEURISY.

The exudations of pleurisy are sometimes sero-fibrinous, sometimes purulent. In the first case, bacteria are not generally found; in the second, the same microbes are found as in the lungs under certain morbid conditions (pneumococci, the bacilli of tuberculosis, streptococci, etc.).

Sero-fibrinous pleurisy is not ordinarily amenable to antiseptic treatment. Strizover (of Odessa) administers salicylate of soda (one gramme three times a day, after meals); the patient then takes a little

*We have seen that creolin is a badly defined body which owes its properties to cresylol, like lysol, which has the advantage of being better defined and is capable of being substituted for it.

strong wine. According to this writer, this treatment is not only followed by rapid recovery, but it serves also to *determine the diagnosis;* that is to say, all cases of pleurisy which do not get well in a few days under the influence of salicylate of soda must be considered as purulent or infectious.

Purulent pleurisy should be treated by thoracentesis (pleurotomy), performed, llke other cutting operations, antiseptically, and followed or not, as seems best, by an injection of an antiseptic liquid.

It is not necessary to describe here the method of operation of thoracentesis. I shall simply indicate the principal antiseptic liquids which are actually employed. The injections ought always to be tepid.

Pure boiled water to which salt is added, boric acid in 4-per-cent. solution, salicylic acid, hydronaphthol (1 : 100), zinc chloride (1 to 8 : 1000), are used to wash out the pleural cavity, until the liquid runs out again absolutely clear. Phenic acid has caused fatal accidents and should not be used, especially in children. These injections are renewed, if expedient, and the drainage-tube which has been placed in the wound enables the medical attendant to watch the state of the pleura. The antiseptic dressing which covers this drainage-tube and the wound must be applied with the greatest care, and should be renewed as rarely as possible.*

* For further details on this subject, see Debove and Courtois-Suffit, "Treatment of Purulent Pleurisy" (Bibl. Med. Charcot-Debove), 1892.

CHAPTER II.

ANTISEPTIC TREATMENT OF DISEASES OF THE DIGESTIVE APPARATUS.

Having treated stomatitis in the preceding chapter, we refer the reader to it, and pass immediately to diseases of the stomach and intestines.

MICROBES OF THE DIGESTIVE TUBE.—A great number of microbes live habitually, we may say normally, in the digestive tube. All those which have already been noted in the mouth are found there, as well as others peculiar to the intestinal canal. They are ordinarily harmless; they may even be of use (Duclaux) in aiding the digestion of foods. In all cases they are compatible with perfect health.

"The physical and chemical conditions which prevail in the digestive tube realize admirably those which experience has shown to be favorable to the culture of micro-organisms (a constant temperature of 100° F., humidity, relative stagnation, periodical arrival of fermentable matter). The digestive tube is the paradise of microbes. Thus, in the world of microbes, harmless, useful, and disease-breeding species live side by side. The species which are habitually harmless when they do not develop in great

numbers, may become injurious by excessive multiplication. As for species truly pathogenic, they are probably present only intermittently."—(Legendre.†)

The stomach, placed at the entrance of the digestive canal, constitutes a veritable barrier to the invasion of pathogenic microbes, owing to the *gastric juice* secreted by its mucous membrane; this fluid by its acid principle is an excellent antiseptic, neutralizing the baneful action of many bacteria. Farther down the intestinal fluids and the bile exercise their protective action, and the microbes are swept along with the fæcal matter to the anus. But if the gastric juice is altered or does not contain its normal proportion of hydrochloric acid; if the bile ceases to be poured into the duodenum, on account of an obstruction in the common bile-duct or from any other cause, digestive troubles immediately ensue, which must be remedied by rational therapeutic measures in which antiseptics occupy the first rank. The incomplete digestion of foods produces gastro-intestinal putrefactions, which are the source of various systemic poisonings by reason of the introduction into the blood of substances normally eliminated with the fæcal matters (indol, skatol, etc.); these putrefactions favor at the same time the abnormal development of microbes. The danger is still greater when bacteria essentially pathogenic, such as those of typhoid fever

† Traité Pratique d'Antisepsie, i, p. 331.

or cholera, are accidentally introduced by drinks, foods, or any other means.

STOMACHAL DYSPEPSIA; DILATATION OF THE STOMACH.

Whatever may be the nature of the dyspepsia, it is often useful to administer antiseptics, but it is preeminently in the forms called *atonic*, *putrid*, *catarrhal*, and *flatulent* that these medicaments are indispensable. Lavage of the stomach, employed especially when there is dilatation, is beneficial in removing alimentary residua which cannot pass into the intestine.

Charcoal powder (Belloc's charcoal) is the oldest of all the antiseptics which have been employed as disinfectants of alimentary matters incompletely digested and remaining in the stomach.

Before the modern antiseptics, such as naphthol, were introduced into practice, M. Dujardin-Beaumetz used weak solutions of boric acid (1 to 2 : 100), or, better, a solution known as sulpho-carbonated water (liquor carbon-disulphide), obtained by shaking perfectly pure sulphide of carbon with water, care being taken to decant the mixture. The following is the formula:

Pure sulphide of carbon.........	25 Gm.
Water.........	100 Gm.
Essence of mint........	30 drops.

Place this mixture in a deep dish of a capacity of about 700 cubic centimetres, shake and allow it to settle. Add water as fast as it is drawn off in order to maintain the liquid

always at the same level and to keep the sulphide covered which settles at the bottom of the vessel. From five to ten tablespoonfuls of this water are given per day in milk or wine and water.

In less serious cases, when the dyspepsia is acid, pituitous, or flatulent, the following capsules may be given (Dujardin-Beaumetz):

Salicylate of bismuth	ää 10 Gm.
Magnesia	
Bicarbonate of soda	

M. Make into thirty capsules; one to be taken before each meal.

In this formula the salicylate is substituted for the subnitrate of bismuth formerly prescribed, being a better antiseptic.

Iodoform has been employed for the same purpose, but has been abandoned because it irritates the stomach.

The introduction into therapeutics of naphthalin, naphthol, and compounds of the same nature, has given us a whole series of antiseptics much easier to administer internally.

It has been found necessary to discontinue the use of naphthalin because of its disagreeable odor and the eructations which it provokes.

Naphthol, on the contrary, does not present any of these inconveniences, and may be employed with advantage, being only slightly toxic (3.80 grammes represents the toxic dose for an animal weighing one

kilogramme). It is generally associated with salicylate of bismuth, as in the following formula (Bouchard):

$$\left.\begin{array}{l}\text{Naphthol-}\beta\text{, precipitated}\\ \text{Salicylate of bismuth}\\ \text{Magnesia (or rhubarb)}\end{array}\right\}\text{ ää. 10 Gm.}$$

For thirty capsules. Take from two to four or more per day, according to indications.

According to M. Bouchard, naphthol-α may be substituted for naphthol-β as a more energetic and less toxic antiseptic (three times less). But the latter is the kind usually found in pharmacies, and precedent has established its use.

Betol, or salicylate of naphthol-beta, appears to be less irritating than naphthol, and may be substituted for it with advantage and in the same doses; it is prescribed as follows:

$$\left.\begin{array}{l}\text{Betol}\\ \text{Salicylate of bismuth}\\ \text{Magnesia}\end{array}\right\}\text{ ää 10 Gm.}$$

For thirty capsules. Two or more per day, some time before meals.

This formula may be varied according to the indications by the addition of bicarbonate of soda, prepared chalk, charcoal, etc., so as to make capsules containing at least one gramme of the antiseptic mixture.

The use of betol is contra-indicated, by reason of the salicylic acid which it contains, whenever the functions of the kidney are disturbed, notably when there is albuminuria.

If it is preferred to employ these different antiseptics pure and without the addition of other powders, they may be given in capsules of 50 centigrammes each.

INTESTINAL DYSPEPSIA; DIARRHŒA; CONSTIPATION; GASTRIC OBSTRUCTION; POISONING BY SPOILED MEATS; ENTERITIS, ETC.

All the antiseptics which we have indicated as useful in the treatment of gastric dyspepsia are of equal importance in intestinal dyspepsia; it may even be said that the greater part of these antiseptics, being insoluble in water and little or slowly soluble in the liquids secreted by the stomach and intestines, act upon alimentary substances only in this part of the digestive canal, or continue here the action commenced in the stomach. We shall see elsewhere that there are distinctions to be made in the choice of these different antiseptics, according to the nature of the lesion.

The purgatives, and preferably the saline purgatives (sulphate of soda, sulphate of magnesia, natural purgative waters), replace here lavage of the stomach, and act by rapidly eliminating foods that are poorly digested or that contain toxines.

Charcoal powder, already employed by Trousseau and Belloc, has been long used by M. Bouchard as an agent in intestinal antisepsis. With the dose of 100 grammes per day (about three ounces and a quarter)

he obtains the deodorization and discoloration of the fæcal matters, and even of the urine by opposing the resorption of bilirubin in the intestine. But charcoal has little action other than as an absorbent; we possess more active medicaments to-day.

Vulpian was the first to employ salicylate of bismuth and iodoform. Others have made use of calomel, which is transformed into a bichloride in the stomach and into a sulphide of mercury in the intestines.

M. Bouchard shows that these substances, generally *insoluble*, should be in the state of an impalpable powder, in order that their particles may come into most intimate contact with the epithelial coat of the intestines; he also points out that it is best to administer them in small doses often repeated, in order not to give the microbes productive of toxines and putrid fermentations sufficient time to multiply.

Naphthalin in the pure state and finely divided has been employed by M. Bouchard; it is obtained in this state by precipitating it with water from its alcoholic solution. Five grammes per day may be given according to the following formula:

Naphthalin Powdered sugar	} āā.............	5 Gm.
Essence of bergamot...............		2 drops.

(Divide into twenty powders. Sig.: Take one every hour.)

Naphthalin has the evil of provoking multiform eruptions accompanied by a pruritus very annoying

to the patient; hence naphthol, which is supported much better, is preferred to it.

Naphthol β is used by M. Bouchard for intestinal antisepsis; its toxic equivalent is but 1.60 grammes per kilogramme of body weight, and, although it is generally considered insoluble, experience shows that it is slightly soluble in water by prolonged shaking (0.20 gramme per 100). By adding a little alcohol to the water, a litre dissolves 0.33 gramme. The naphthol-water thus prepared possesses an incontestable power as an antiseptic.

Naphthol or betol may be administered according to the formulæ previously indicated for the treatment of gastric dyspepsia, or, if preferred, in the form of granules (Bouchard). The formula is as follows:

Charcoal	....	50.0
Naphthol Salicylate of bismuth	} ää	2.50
Sugar, q. s. to produce granulation.		

Granules convenient for use may thus be prepared. Dose, a teaspoonful in a little water.

But the medicament which appears to suit best in intestinal dyspepsia, according to the most recent researches, is benzonaphthol.

Benzonaphthol, or benzoate of naphthol β, is, according to M. Gilbert, the best antiseptic for the intestine, seeing that it is there only that it acts, while naphthol itself is a *gastro*-intestinal antiseptic the action of which begins in the stomach.

Benzonaphthol enters the intestine without being modified by the gastric juice; it there breaks up into naphthol β and benzoic acid. Consequently it is an *intestinal* antiseptic exclusively.

The feeble solubility of benzonaphthol in water and the gastric juice limits, then, its field of action. But this medicament has the advantage that it does not disturb the chemical processes of the stomach when they are normal. *Betol* also possesses this quality.

Benzonaphthol presents the advantage over betol of having a superior antiseptic power in consequence of the substitution of benzoic acid for salicylic acid. It is also to be noted that whenever the kidney is diseased, as in Bright's disease, salicylic acid is dangerous even in small doses; besides, benzonaphthol is much less toxic. In diseases of the liver and in nephritis, then, the latter medicament is exclusively indicated. It is administered in doses of two to five grammes per day, in capsules of ½ gramme (7½ grains) at regular intervals.

To sum up: For gastric antisepsis, lavage is the principal resource, while gastro-intestinal antisepsis should be effected by naphthol β, and antisepsis exclusively intestinal by benzonaphthol.

It will, then, be advisable to employ benzonaphthol in preference to the sulphide of carbon and to naphthol, with or without the addition of salicylate of bismuth, in typhoid fever, diarrhœa of microbian

origin, dysentery, enteritis, typhilitis, and colitis, whatever may be the cause.

The simple or antiseptic lavements constitute medications of easy application whose indications are found not only in rectitis of infectious origin, but also in all affections of the large intestine. Solutions of boric acid, tannin, lead acetate, perchloride of iron, iodine in iod. pot. solution, silver nitrate, corrosive sublimate, etc., have been employed successfully. Injections play the same antiseptic rôle here as lavage of the stomach and saline purgatives in other parts of the digestive tube.

FURUNCULOSIS.

The furuncle (boils, carbuncles, etc.) should be considered as the cutaneous manifestation of a general affection which is always accompanied by the production of toxines in the intestine. It is, then, necessary to associate with the local treatment of the furuncles a general treatment, the basis of which is intestinal antisepsis, together with a rational hygiene.

M. Bouchard has shown that a furunculous eruption may be arrested by intestinal antisepsis. It has also been long known that a close relation exists between the functions of the intestines and those of the skin. In furunculosis, besides the local infection which is caused by the dissemination of microbian germs on the cutaneous surface, there is need of taking into account the predisposition which results from systemic poisoning of intestinal origin, and from

the consecutive irritation which, joined to the rubbing and the scratching, favors the inflammation of the sebaceous follicles which constitute a means of entrance for pyogenic microbes (staphylococci and streptococci.

With the local treatment, consisting of lotions of boric acid or corrosive sublimate, and applications of rings of *emplastrum de Vigo cum mercurio* to each papule, whether suppurating or not, intestinal antisepsis should be associated. M. Bouchard gives the following capsules:

Naphthol β, finely pulverized........	15.0
Salicylate of bismuth................	7.50

For thirty capsules. Take from three to twelve per day.

M. Gingeot paints the furuncle with tincture of iodine, and makes general lotions with water containing boric acid, sulphur, or corrosive sublimate, while administering internally the following powder:

Sodium sulphide	ää 10 Gm.
Bicarbonate of soda	
Sulphate of potash	
Tartaric acid	
Gum arabic	

From one-half gramme to four grammes per day, in eight or ten doses, in water or milk.

ANTISEPSIS OF DISEASES OF THE LIVER.

It is well known that the liver, continuously traversed by blood from the intestines, has for one of its

functions the arresting of toxines which, fabricated by microbes in the alimentary canal, are brought to the liver by the portal vein, and which are later eliminated by the kidney. It is supposed that this neutralization of the toxines of the blood is related to the glycogenic function of the liver (G. H. Roger).

But whenever the hepatic gland is morbidly deranged, this faculty of arresting or neutralizing toxines is altered or suspended. This is what is observed in simple icterus (jaundice), in grave icterus, in hepatitis and cirrhosis, and even in those transient engorgements of the liver which nearly always accompany intestinal affections, fevers, etc. In all these diseases, internal antisepsis is the more obligatory from the fact that the kidney is equally menaced by reason of the presence in the blood of bilirubin, a product of excretion of the liver ordinarily poured into the intestine, which colors abnormally the urine and all the liquids of the human economy.

Whenever there is an obstruction of the common bile-duct, from any cause, icterus ensues, and, the bile ceasing to be poured into the duodenum, the fæcal matters are expelled decolorized and exhaling a putrid, repulsive odor. The bile is, in fact, an energetic antiputrid agent, and opposes the microbian fermentations which may arise in the intestines from the presence of alimentary residua. M. Dujardin-Beaumetz has insisted upon the necessity of opposing this intestinal putridity, to which he assigns a

causative rôle in the production of the nervous symptoms attending prolonged icterus—the disturbance being immediately due to the absorption of toxines into the organism from the surface of the intestines.

The antiseptics which agree best in these cases are calomel (the purgative action of which may be utilized by associating it with euonymin), charcoal powder, and especially *benzonaphthol*, conformably to the indications formulated above.

ANTISEPTIC TREATMENT OF PERITONITIS.

The inflammation of the peritoneum is either primary (?), or consecutive to inflammation of some one of the abdominal organs. Even when this inflammation is not at first septic, it almost always becomes so after a time, either by reason of perforation of the organ affected, or by the inflammatory process itself, which renders possible the migration of leucocytes and microbes through the inflamed and friable walls of the abdominal viscera.

The microbes which are found in the peritoneal exudation are of species varying according to the primary affection of which the peritonitis must be considered a complication. The most common are the *Staphylococcus aureus*, the *Streptococcus pyogenes*, the *pneumococcus* (*Klebsiella salivaris*), and *Bacillus tuberculosis;* the last is the bacillus usually found in the peritonitis of children.

According to MM. Cornil and Babes,* "peritonitis is invariably secondary to a lesion which takes its point of departure in the inflammation of some organ contained in the abdominal cavity, or else in the generalization of certain microbes which have a special effect on the serous membranes"—as those cited above. It may be said that microbes are present in every acute peritonitis, fibrinous or puriform.

The first indication in peritonitis is to effect internal antisepsis as complete as possible by the means already indicated; calomel, and principally naphthol and benzonaphthol, should be administered according to the formulæ previously given, account being taken of the greater or less tolerance of the stomach. The salts of quinine, if indicated, may be associated with these medicaments.

Peritonitis being always local at the start, and the gravity of the affection depending essentially on its generalization, which renders it rapidly fatal, all the efforts of the physician should tend toward the prevention of the spread of the inflammation, especially when this is primarily of septic origin.

"The extension of a peritonitis," says Bouchard, "consists in a succession of inoculations resulting from the movements of the intestine, which break up and diffuse the septic matters effused between the convolutions, or the liquid exudate secreted by the serosa, and containing the pathogenic agents. It is the in-

* Cornil and Babes, "Les Bactéries," 3d ed., ii, p. 40.

testines themselves which transport the septic organisms and disseminate them. There is, then, an urgent indication to prevent this transportation by immobilizing the intestine in order that the peritonitis may remain circumscribed. This is indirect antisepsis."*

This result is attained (or sought) both by internal and external treatment.

Internally, purgatives must from the first be avoided, from fear of generalizing the peritonitis. Hence, even when calomel is given, as in infantile practice, it must be associated with opium. [This is old practice, now abandoned. In American practice we do not fear to open the bowels by a full dose of calomel at the onset, nor to give saline purgatives occasionally during the disease, and recovery oftener coincides with freedom of the bowels than with constipation.—TRANS.]

Opium is, in this respect, a heroic medicament which calms the pain in immobilizing the intestine. [It may be necessary to give a grain of solid opium every hour or two in pill form, or a tablet of morphia, one-eighth to one-fourth grain. The morphine may, if preferred, be given subcutaneously, with or without atropine. Some practitioners prefer the deodorized laudanum, of which from ten to twenty drops may be given every two hours, according to indications. Patients bear immense doses of opiates in

* Bouchard, *loc. cit.*

peritonitis. I have known it to be necessary to give half a grain, and even a grain, of opium in pill form every hour for several days. I think most practitioners in this country prefer the *pil. opii* to every other form.—TRANS.]

Constipation, even when prolonged for a fortnight, is much less dangerous than movements of the bowels provoked by the unseasonable and forced introduction of aliments, sure to be followed by vomitings which agitate and disturb the contents of the abdomen (Bouchard). The physician should be content with iced water in small quantities, and, for nourishment, lavements by the rectum. [Excellent nutrient lavements are made with peptonized beef stirred into milk, pancreatinized milk, milk and egg with a little dilute muriatic acid and pepsin, etc. Not more than four or five fluidounces should be injected at a time, and not oftener than every five hours. The injections are better retained with the help of a few drops of laudanum.—TRANS.]

The external treatment consists in immobilizing the walls of the intestines by different means: layers of wadding kept on by a bandage; a coating of castor oil and collodion; ice over the abdomen, care being taken to place a piece of thick flannel between the ice-bag and the abdomen (Siredey).

M. Debove, in order to avoid the surgical treatment with all the apparatus of laparotomy, in tuberculous peritonitis, makes a puncture with the trocar

of the aspirator, and washes out the abdomen with two litres of a saturated solution of boric acid or with water sterilized in a dry stove (*autoclave*) at 120° C. (about 260° Fahr.).

Topical applications over the abdomen may be themselves antiseptic: inunctions of mercurial ointment or other substances of the same nature. Recently ichthyol has been recommended, applied so as to form a thick coating and then covered with sticking-plaster; the whole is kept in place by a bandage. These different topical agents give results very superior to vesicatories, which are generally badly supported. The antisepsis of the genital organs is imperatively indicated in women, especially when the peritonitis is of uterine origin; it may be accomplished by means of appropriate injections.

In all cases it must not be forgotten that intestinal antisepsis renders possible and inoffensive the immobilization of the intestines, carried as far, even, as constipation (Bouchard), for this is only dangerous by the putrefaction of matters retained in the intestines, and antiseptics prevent this putrefaction.

CHAPTER III.

ANTISEPSIS OF DISEASES OF THE CIRCULATORY SYSTEM.

ENDOCARDITIS, MYOCARDITIS, PERICARDITIS, DISEASES OF THE BLOOD-VESSELS.

Endocarditis must be considered as a secondary disease following acute articular rheumatism, pneumonia, typhoid fever, puerperal infection, or coming in the train of pyæmias and septicæmias consecutive to wounds. But all these diseases, notably pneumonia, acute rheumatism, typhoid fever, etc., "are due to the presence of micro-organisms, and are in reality infectious diseases; so that we may consider endocarditis as equally in relation with the bacteria which circulate in the blood" (Cornil and Babes). We owe the first mention of bacteria in ulcerous endocarditis to Rokitansky (1855), although he did not indicate the microbian nature of the granulations of which he gave an excellent description.

Bacteria are also observed in myocarditis and pericarditis. These two affections are usually seen as complications of valvular ulcerous endocarditis. Pericarditis may, however, precede endocarditis and provoke it, being itself caused by pyæmia—notably by a phlegmon of the mediastinum.

Endocarditis is frequently complicated by metas-

tatic infarctions and abscesses due to the transportation by the general circulation of fibrinous fragments filled with microbes. Endarteritis is observed also either as a primary affection or as the result of endocarditis.

The principal microbian agents of these lesions are, first, those of pus (*Staphylococcus pyogenes aureus* and its varieties *albus* and *cereus albus*, *Bacillus pyogenes fœtidus* of Passet, *Streptococcus pyogenes*), then the pneumococcus or lanceolated diplocococcus (*Klebsiella salivaris*), the *Bacillus tuberculosis*, saprogenous bacilli, etc.

The antiseptic treatment of the diseases of the circulatory system is much less advanced than that of the diseases of the digestive apparatus, because of the difficulty of instituting a local treatment. The problem here is, in short, to realize internal antisepsis and reach the microbes which circulate in the blood and are carried by it to the heart and blood-vessels. This result is not possible except by *general antisepsis*, which is exceedingly difficult to effect by the means at our disposal, since clinical experience has not yet sanctioned intravenous injections of soluble antiseptics which seem to be theoretically indicated.

As for the insoluble or slightly soluble antiseptics, such as naphthol, administered by the alimentary canal, they act also, perhaps, in a certain measure as general antiseptics by the slight portion which is absorbed. But these medicaments necessarily pass

through the liver, which diminishes the antiseptic power of substances which traverse it, as it diminishes the toxicity of septic substances which pass the same way. However, these antiseptics are found to be of some use, particularly in the treatment of the local malady, the first cause of the circulatory lesions which occupy us here, and in accomplishing intestinal antisepsis, which must not be neglected, especially in view of the complications liable to ensue in the renal emunctory.

The antiseptics soluble in the alimentary canal, such as salicylate of soda, find their use notably in the treatment of rheumatic endocarditis. The salts of quinine, which enter into the same category, are indicated in the cardiac affections consecutive to pyæmia, and even in rheumatism (Bucquoy).

For antisepsis at once intestinal and general, preference will be given to *benzonaphthol* by reason of its favorable action on the function of the kidney, and it should be administered concurrently with diuretics and the milk diet.

Among the medicaments still used in the treatment of pericarditis and endocarditis, and which are associated more or less with the class of antiseptics, it is well to mention tartar emetic given in large doses (Jaccoud), and the iodides. The latter, as well as the bromides, are indicated in the greater part of the diseases of the heart (G. Sée). The iodides act at the same time as tonics, the bromides as hypnotics.

CHAPTER IV.

ANTISEPTIC TREATMENT OF DISEASES OF THE URINARY AND GENITAL APPARATUS OF BOTH SEXES.

In this chapter will be treated diseases of the kidney, bladder, and external genital organs. A special chapter will be devoted to midwifery and gynæcology.

Infectious Nephritis.—Inflammation of the kidney of microbian origin may be either primary or consecutive to a general infectious malady (traumatic septicæmia, erysipelas, osteomyelitis, diphtheria, scarlatina, etc.). A large number of species of bacteria may be present in the kidney, and consequently in the urine. Nevertheless, some of these microbes circulate in the blood without producing lesions of the renal parenchyma (septicæmia of the mouse and rabbit, according to Koch), and microscopical examination of the urine does not in this case show bacteria (Cornil and Babes). We know, moreover, that normal urine does not contain microbes, but that they are habitually present when the blood which traverses the kidney is charged with notable quantities.

The species of microbes found in the urine are generally those of the initial malady, but frequently

they are associated with suppuration or gangrene consecutive thereto.

The experiments made by MM. Cornil and Berlioz with the bacillus of jequirity,* prove that the kidney is one of the principal avenues of elimination of the microbes of the blood; this elimination is rapid, and may proceed without any appreciable inflammation of the uriniferous tubes. In poisoning by jequirity, which is rapidly fatal in the frog, "sections of the kidney show a colossal quantity of bacilli in all the vessels, and numbers of these organisms both in the cavities of the glomeruli and in the interior of the uriniferous tubules. The urine collected from the bladder also contains bacteria. However, although the presence in the blood and the elimination of these organisms by the kidney may have lasted several days, the cells of the uriniferous tubules appear normal; the cavity of the tubules is not dilated and does not contain products of pathological secretion. If a great quantity of the infusion of jequirity (two or three cubic centimetres) be injected into one of the large veins of a rabbit's ear . . . . . bacteria appear in the bladder an hour and a half after the injection" (Cornil and Babes).

The experimental demonstration of these facts is

---

* It is now known that this bacillus, which probably does not differ from the *Bacillus subtilis*, does not possess the pathogenic properties formerly attributed to it, but that these are due to *abrine*, the principal soluble poison of jequirity.

very important from the point of view of the therapeutics of infectious diseases. It proves that *so long as the kidney is intact*, or nearly so, and accomplishes normally its function as a filter of the blood — an intelligent filter, or "*selective filter*," according to the expression of M. Dujardin-Beaumetz—the elimination of microbes by this emunctory is possible. It explains also the danger of infectious diseases in persons affected with diseases of the kidney (albuminuria, Bright's disease). It moreover establishes the indication that it is of great importance in all diseases of microbian nature to favor the function of the kidney by appropriate diuretics, so as to prevent the sojourn and accumulation in the uriniferous tubules of microbes which will in the end provoke inflammation of these tubules by the production of toxines.

Under the name of *ascendant nephritis* are classed those diseases in which the microbes, instead of being carried to the kidney by the general circulation, ascend from the bladder, which is affected with purulent cystitis, and enter the uriniferous tubules by way of the ureters and the calices. This form presents itself in calculous cystitis, in compression of the ureters by ovarian tumors, cancers of the cervix uteri, etc. It may be consecutive to simple catheterization when this operation is not aseptic. The microbes encountered in this case have been studied by Clado (Thèse de Paris, 1887), and consist of a dozen different species, of which one, which he has described under

the name of *septic bacterium of the bladder*, seems peculiar to this form of cystitis and nephritis. It is the *Bacterium pyogenes* of Albaran and Halle (1888). More rarely, nephritis consequent upon blennorrhagia, and provoked by the *Micrococcus gonorrheæ* (Neisser), is observed. Other micrococci have been described by Doyen (1887) as present in the urine of patients affected with cystitis and pyleo-nephritis.

Despite what has been above stated, according to experiments made on animals to throw light on the probable passage of bacteria through the kidneys without appreciable trace of local inflammation, autopsies made on man after death from infectious nephritis seem to show that bacteria do not not pass in any great numbers into the urine except through manifest renal lesions (inflammation, vascular ruptures, ecchymoses, etc.). In all cases, the local action of microbes and their toxines is much more intense when the kidney is affected with some trouble of nutrition (Cornil and Babes). Albuminous urine nearly always contains leucocytes and bacteria in greater or less numbers. The danger is much greater when this albuminuria is chronic.

Antiseptic Therapeutics of Nephritis.—Diuretics, empirically employed since ancient times, here accomplish the same rôle of irrigation as lavage of the stomach and saline purgatives in affections of the digestive tube. The urine being scanty and thick, there is an indication to render it more abundant and

to dilute the saline substances which it contains so as to diminish the mechanical obstruction of the renal filter.

Purgatives and vapor baths, used concurrently, supplement the renal function by enlisting the intestines and the skin in the work of eliminating urea and other products of excretion normally removed by the urine, as well as the toxines which, on account of renal insufficiency, may have been left in the blood.

Milk, in the exclusive milk-diet treatment, acts at once as a diuretic and as a complete aliment. It has the advantage over all other aliments of being easily supported, of modifying the albumen of the blood, and of reëstablishing the functions of nutrition (Dujardin-Beaumetz) by introducing into the stomach and intestines the nutrient which demands the least possible digestive labor, and which, consequently, penetrates the most rapidly into the economy, offering the minimum of material for putrid fermentation in the intestines. Whenever it is possible, fresh milk is prescribed, uncooked and raw, in order to realize as nearly as possible the conditions which nature has indicated in preparing this food for the new-born child. One to three quarts per day may be prescribed, pure or with the addition of Vichy water (Saint-Yorre) or Vals water (Saint-Jean)—a large spoonful to each glass of milk—which aids its toleration by irritated stomachs, especially when there is an excess of acidity of the gastric juice.

In place of cows' milk, M. Lancereaux prescribes asses' milk, or, if this cannot be obtained, cows' milk that has been kept less than twelve hours and well skimmed. To this should be added four to ten grammes of sodium chloride per quart. This treatment must not be continued more than eight days if the patient does not improve.

Vegetable diuretics (digitalis, uva ursi, horseradish, scoparius, squill, etc.) are employed in infusion, singly or associated with cream of tartar.

Milk sugar, or lactose, is also an excellent diuretic, recommended by M. Germain Sée, in doses of 100 grammes (between three and four ounces) per day, in all cases where the milk itself is poorly supported. MM. Dujardin-Beaumetz and Dastre have shown that *glucose* produces the same effects, but in larger doses (200 grammes daily in ptisan). The latter medicament is generally better tolerated by reason of its taste, which resembles more nearly that of common sugar.

Benzoic acid is the diuretic antiseptic *par excellence*. It is employed pure or in the form of benzoate of soda or benzonaphthol.

M. Laboulbène prescribes as a ptisan the following potion:

Benzoic acid	1.0 to 2.0
Sugar...	100.0
Distilled water......	950.0

Sig.: To be drank in tumblerfuls.

Glucose may be substituted for common sugar if it is desired to utilize the diuretic properties of grape-sugar.

Benzoate of soda presents the advantage over benzoic acid of being quite soluble in water (while one gramme of the acid demands 400 grammes of water). It is used in doses of one to three grammes (15 to 45 grains) in a potion of 150 grammes (5 ounces), to be taken by tablespoonful doses. It is especially serviceable in the uric diathesis.

It may be prescribed in the form of a solution (Dujardin-Beaumetz):

Benzoate of soda..................	10.0
Orange-flower water....	20.0
Distilled water....	270.0

This solution contains one-half gramme (7½ grains) of benzoate per tablespoonful. Ten grammes (150 grains) of bicarbonate of soda may be added.

The *dialytic syrup* of Bonjeau contains:

Benzoate of soda.................	30.0
Silicate of soda..................	50.0
Syrup of acacia..................	1000.0

(One to two tablespoonfuls per day.)

Tannin, either pure or in the form of red wines rich in tannin, has also been employed for albuminuria.

Fuchsin is to-day more in favor. For the child,

M. Bouchut prescribes the following potion associated with the milk diet and sudorifics (wet-packs):

Fuchsin	0.50 Gm.
Essence of mint................	2 drops.
Syrup of acacia	100.0 Gm.

(By teaspoonfuls during the day.)

This medicament has the disadvantage of coloring the lips and teeth red; it is for this reason better to administer it in capsules whenever possible, particularly in the adult.

M. Dujardin-Beaumetz prescribes, concurrently with injections of pilocarpine (sudorific), the following capsules:

Fuchsin, 0.50 Gm.

(In two capsules, to be taken during the day.)

Intestinal antisepsis may be effected by benzonaphthol either singly or associated with magnesia, bicarbonate of soda, etc., in doses of ½ gramme (7½ grains) of this antiseptic in capsules or wafers, to be taken at meal-time.

Oxygen in inhalations is one of the best treatments to employ in albuminous nephritis (Dujardin-Beaumetz), especially when it is necessary to combat rapidly accidents due to blood-poisoning.

INFECTIOUS CYSTITIS.

The indications in cystitis resemble much those of nephritis. Combat first the inflammation of the

bladder, and dilute the urine charged with toxic principles by warm emollient drinks, alkaline and sulphur waters, like those of Contrexeville, Vichy, or the lithia waters like the Buffalo lithia. The milk diet is to be imposed. If the urine is purulent, it will be well to wash out the bladder with warm boric-acid water, though such lavage is contra-indicated in acute cystitis.

Benzoate of soda may be administered, according to the following formula:

Benzoate of soda Benzoate of lithia	} ää	1.50
Syrup of Tolu.....................		50.0
Distilled water....................		100.0

M. Sig.: The whole to be taken during the twenty-four hours, in frequent tablespoonful doses.

Turpentine or sandalwood-oil may be given in capsules to modify the urine and prevent ammoniacal putrefaction. Purgatives act as derivatives to the intestines.

In acute cases, Guyon employs instillations of nitrate of silver, carried to the fundus of the bladder. The patient is first made to urinate, and a No. 13 or 14 instillator-catheter is used. When once the membranous urethra is passed, the handle of the catheter is depressed and the point brought forward nearly to the sphincter vesicæ. The instillation is begun in the prostatic portion. The quantity instilled is twenty to

thirty drops of a 1:50 solution. After several days the solution can be increased to 1:40 or 1:20.

In chronic cystitis, Guyon prescribes injections of nitrate of silver, 1:500, one or two fluidounces; the injection is stopped when the fluid comes out clear. At the same time, pills are given every four hours, consisting of 2 grains each of Venice turpentine and extract cinchona.

The following prescription is also advised along with the balsams:

Benzoic acid.....................	4.0
Glycerin	4.0
Mistura acacia...................	120.0

M. Sig.: A tablespoonful every three hours.

Intra-vesical injections are indicated whenever the urine is stagnant. [For this purpose the rubber hand-ball syringe adapted to a soft-rubber catheter may be employed; the injection should be thrown slowly, at about the heat of the blood. The hand-ball syringe should hold about two ounces, and this quantity should be allowed to flow out before a new quantity is injected.] The liquids to inject are boric acid, 4 per 100; sulphate of copper, 1 per 100; tannin, 1 or 2 per 100; phenic acid, 1 per 100; nitrate or silver, 1 per 500.

In chronic blennorrhagic urethro-cystitis, it is well to instill ten to twenty-five drops of the above solution of silver nitrate into the prostatic urethra.

BLENNORRHAGIA IN BOTH SEXES.

Blennorrhagia (gonorrhœa) is produced by the inoculation in the canal of the urethra of the micrococcus or gonococcus of Neisser. This very rebellious affection, which is often complicated with cystitis, tends to become chronic. The most energetic antiseptic treatment is indicated from the very onset of the disease, if we would prevent the inflammation of the urethral mucosa from being propagated to the bladder. Especially should the physician use precaution that the treatment and, above all, the *ascending injections* do not contribute to the propagation upwards of the microbic infection primarily localized in the anterior part of the urethra. To avoid such propagation, it is better to use the *syringe with retrograde jet* devised by Langlebert, the cannula of which should always be previously sterilized.

According to Mauriac, it is well to begin with the balsams, which may of themselves cause a definitive cure. The antiseptic *abortive* treatment has no chance of succeeding unless resorted to the first day or so following the infection; but the physician is never consulted at that time. Later on it is dangerous.

The balsams commonly given are copaiba, sandalwood oil, and gurjun oil. The following are English recipes:

Ol. santali .... ℥ ss.
Liqui. potas........................ ʒ ij.
Syr. acaciæ........................ ℥ j.
Aquæ fœniculi..............q.s. ad ℥ iij.

M. Sig.: A teaspoonful well diluted after eating.

℞ Bals. copaiba........................ ℥ ss.
Liquor potass .... ʒ ij.
Syr. Tolu........................ ℥ jss.
Ext. licorice .... ʒ ij.
Aquæ menth. pip............q.s. ad ℥ iij.

M. Sig.: One or two teaspoonfuls.

℞ Bals. copaiba........................ ʒ iv.
Syr. Tolu
Syr. acaciæ } ää.............. ʒ viss.
Aquæ menth. pip.

M. Shake. Sig.: Teaspoonful.

It is generally expedient to wait eight or ten days, till the acute stage has subsided, before giving copaiba, and when the copaiba, sandalwood or gurjun oil is given it should be in frequently repeated doses so that the urine may be always charged with the active principle at the time of emission (Dujardin-Beaumetz). One of the copaiba capsules may be given every four hours, then every two hours, as the stomach will bear them.

Vidal's formula for gurjun oil is as follows:

Gurjun oil
Gum arabic } ää.................... 4.0
Infus. anise........................ 40.0

M. Sig.: To be taken in two doses.

For injections the practitioner may use zinc sulphate or zinc sulpho-carbolate, one or two grains to the ounce; lead acetate, one grain to the ounce in decoction of poppies; or tannic acid, according to the following formula:

Acid, tannic Alum	ää	1.0
Red wine Rose-water	ää....................	100.0

M.

Or 3 parts of tannin to 100 of glycerin for a topical application. Permanganate of potash, lime-water, corrosive sublimate (in weak solution, 1:50000) have also been recommended. [The routine treatment at the Johns Hopkins, Baltimore, Hospital is the injection of corrosive sublimate, night and morning, by means of a fountain syringe and suitable cannula; the strength of the injection is seldom greater than 1:50000].

Of the anti-parasitic injections, permanganate of potash has a high rank. The strength of the injection should not be greater than one grain to five fluidounces of water.

For other prescriptions, the reader is referred to any modern text-book on venereal diseases.

M. Dreyfus prescribes salol internally as the best antiseptic of the urinary organs, because all its action is brought to bear on these organs. Salol breaks up in the intestine into phenic and salicylic acids, which are both eliminated by the urine, the first in the state of

phenyl sulphate, the second as salicylic acid; salol thus might be supposed to have an analgesic action similar to that of the salicylate of soda in rheumatism.

Salol is prescribed in doses of five to eight grammes per day, either alone or associated with the balsams. This medicament would be contra-indicated in acute or chronic albuminous nephritis.

M. Vigier has recently recommended retinol, which is of easy application. In blennorrhagia it acts upon the discharge much more rapidly than the other antiseptics, and effects prompt amelioration. It causes no pain, and always appears to be well supported.

Blennorrhagia in the female is treated in the same manner as in the male. The affection is less obstinate and yields more easily to injections of sulphate of zinc, sulphate of copper, corrosive sublimate, etc.

The physician will be on the alert to avoid complications on the part of the uterus and its annexes, such as might follow sublimate injections, or inunctions with mercurial and belladonna ointments. When these complications occur, the treatment is similar to that of peritonitis.

The local antiseptic treatment of leucorrhœa does not differ from that of blennorrhœa.

The treatment of chronic blennorrhagia is much like that of cystitis, and is based upon the use of nitrate of silver (Guyon). The method of procedure is here of great importance, and is as follows: A flexible gum bougie with bulbous tip, hollow

throughout its whole length, and having at the top of the bulb a filiform orifice, is introduced to the proper depth. A Pravaz syringe holding three cubic centimetres, with conical cannula, is adapted to this bougie. The apparatus must be primed before using; for this purpose, the syringe being charged and fixed to the sound, the operator presses the piston till a drop appears at the orifice at the end of the bougie.

For the posterior urethra, it is necessary after passing the membranous portion to push the piston so as to inject from twenty to thirty drops.

For the anterior urethra, after having hit against the entrance of the membranous portion, the explorator is withdrawn about two or three centimetres, and from three to six drops only are slowly injected, the instrument being left in place a few minutes.

Care must be taken to have the patient urinate before the operation. These instillations are repeated every two days. The solution used is 2 per cent., rarely as high as 4 per cent.

VAGINITIS.

The local antiseptics are indicated in this affection, which is often accompanied by vaginismus. They are generally applied by a tampon soaked in the medicament and allowed to remain in place from twelve to twenty-four hours.

M. Dujardin-Beaumetz prescribes:

Gurjun balsam....................	1 part.
Lime-water.......................	2 parts.

(Applied by tampons soaked in the solution and allowed to remain in place twenty-four hours.)

Injections are also made with chloral or with permanganate of potash—of the former, 20 grammes to 200 grammes of water; of the latter, 15 centigrammes to a pint of water.

The following is also recommended:

Tincture of iodine...........	20.0 to 40.0
Iodide of potassium..............	q. s.
Distilled water...................	1000.0

Also:

Salicylic acid.....................	1.0
Alcohol, 90-per-cent........... ...	10.0
Distilled water....................	100.0

A tablespoonful in a quart of cold water for one injection.

Sulphate of iron may also be used (10 grammes per half-litre [1 pint] of water).

A tampon soaked in retinol and left in place from twelve to twenty-four hours succeeds very well and causes no pain (Balzer).

BALANITIS.

If the emollient lotions and boric water do not suffice in this affection, a dressing may be made with powdered oxide of zinc, either dry or in suspension in retinol. Calomel may also be used, or a solution of lead acetate by means of pledgets used in dressing.

In graver cases it may be necessary to brush the parts lightly with argent. nitras, 1:50. Almost all the antiseptics have been employed in such cases.

The general and local treatment of syphilis will be indicated in the chapter on General Diseases.

CHAPTER V.

ANTISEPTIC TREATMENT OF DISEASES OF THE LOCOMOTOR APPARATUS AND OF THE NERVOUS SYSTEM.

DISEASES OF THE LOCOMOTOR APPARATUS.

Although a certain number of the diseases classed under the title of *Diseases of the Locomotor Apparatus** are manifestly consecutive to affections of microbian origin, the antiseptic treatment of these diseases has advanced too little to render possible separate methodical treatment for all.

In these affections the physician will content himself in endeavoring to effect general and intestinal antisepsis, and will treat the secondary complications conformably to the rules previously formulated.

Rheumatism is ordinarily considered as a general disease. We shall, however, treat it here, because the most recent researches seem to indicate that diseases of infectious nature due to the presence in the blood of various species of microbes are often clinically confounded under the name of rheumatism. At the same time, in the actual state of our knowledge respecting this subject, it is not possible to separate

---

* Progressive muscular paralysis, and progressive muscular atrophy (myopathic atrophy).

the different antiseptic treatments applicable to the different forms of rheumatism.

RHEUMATISM.

It is known that certain manifestly infectious states (local suppurations, puerperality, blennorhagia, scarlatina, mumps, dysentery) are accompanied or followed by morbid determinations to the joints and serous membranes which clinically resemble acute articular rheumatism of pronounced form due to the influence of cold and dampness (*secondary rheumatisms*, or *pseudo-rheumatisms*—Dieulafoy).

It is but a step further to admit that idiopathic rheumatism itself is a microbian disease, and it may soon be so proved.

In two cases of acute or subacute articular rheumatism, both of which terminated in fatal nephritis, Cornil and Babes* found the kidneys filled with bacteria, manifestly the cause of the polyarthritis and of the nephritis. Observations of this nature are every day becoming more numerous since the histological and bacteriological examination has become the necessary complement of autopsies.

Without denying the influence of cold and dampness—which evidently act here as a determining cause by paralyzing the cutaneous emunctory and causing the retention in the blood of substances ordinarily eliminated by the perspiration and urine (uric and

* "Les Bactéries," third edition, I, p. 530.

lactic acids, salts of lime, etc.)—it is probable that in many cases, and particularly in the most grave cases which resist rational treatment or terminate fatally, there is reason to assume the presence of a microbe which transforms a simple dyscrasia into an infectious disease. M. Bouchard considers that *chronic deforming rheumatism* is an affection amenable to antiseptic therapeutics, and one which "includes many diseases, the beginnings of which are different." The treatment here is the touchstone of diagnosis, and the good effects of intestinal or general antisepsis are proofs of the microbian nature of the affection (Bouchard).

Antiseptic Treatment of Rheumatism.—The heroic, almost specific, medicament for acute articular rheumatism is salicylate of soda, which is administered in solution according to the following formula (Dujardin-Beaumetz):

Salicylate of soda..................	15.0
Distilled water.....................	250.0

A tablespoonful contains about one gramme (15 grains) of the salicylate. This dose may be repeated every four hours. When the pain ceases, two to three grammes only per day are given during a fortnight.

M. Bouchard associates with salicylate, bicarbonate of soda in doses of 10 grammes (150 grains) per day.

The urine should always be examined for albumen, which, if present, contra-indicates salicylate of soda. Careful surveillance must be had also of the

condition of the brain of the patient, so as to avoid all danger of poisoning by this medicament. Moreover, it should not be administered during pregnancy.

When the salicylate is contra-indicated—that is, if the patient is suffering from Bright's disease—M. Bucquoy replaces it by sulphate of quinine, antipyrine, or Dover's powder, while Dujardin-Beaumetz gives exalgin and phenacetin. The latter authority is at present experimenting with naphthol-β associated with the monosulphate of calcium, which renders it very soluble. In doses of 25 centigrammes per day this combination gives good results in rheumatism.

Even in children of over ten years, it is necessary to give at the onset large doses of salicylate of soda (6 grammes — ʒ jss—during the day) in doses of one gramme (15 grains), either in capsules or spirit solution (wine and water). Doses of two to three grammes per day have no effect whatever. If this medicament, taken in capsules, is poorly supported by the stomach, Vichy water aids its toleration. In patients under ten years, three to four grammes are given daily; in patients under six years, two to three grammes.

M. Chauffard gives preference to antipyrine in doses of four to five grammes per day. This medicament never gives rise to the painful cerebral effects which sometimes follow the administration of the salicylate. To moderate the diaphoresis produced by

antipyrine, several granules of the neutral sulphate of atropine may be given. To this may be added the milk diet and diuretic drinks.

When salicylate is contra-indicated (nephritis, pregnancy, cardiopathy, etc.), M. Barth gives sulphate of quinine and antipyrine associated according to the following formula:

Sulphate of quinine................	0.50
Antipyrine.................... ...	0.50

(For one capsule—To be taken *post cibum.*)

According to M. Faisans, the efficacy of salicylate in idiopathic rheumatism is the touchstone of diagnosis. When this medication does not produce good results it is because there is some specific or pyæmic infection localized in the joints, and not true rheumatism.

In blennorrhagic rheumatism, M. Besnier prescribes the iodide of potassium as soon as the discharge has ceased. It is indispensable to immobilize the affected joints—a practice always the rule, and especially so in secondary rheumatism. If necessary, above all when the affection is fixed in one or more joints, the physician will apply revulsives (tincture of iodine, punctiform cauterizations).

The iodide of potassium, or the syrup of iodide of iron (a dessertspoonful twice a day for a fortnight, at meal time*), is administered by J. Simon in chronic rheumatism of children.

---

*The dose of the English syrup would not exceed twenty to forty minims.

The iodide of lithium is prescribed by M. Huchard in doses of twenty-five to fifty centigrammes (four to eight grains) per day in gout, a disease also treated by others with salicylate of soda.

Tetanus will be treated in the chapter on General Diseases.

DISEASES OF THE NERVOUS SYSTEM.

The antiseptic treatment of these diseases reduces itself, in general, to the treatment of the multiple complications of the digestive, circulatory, and respiratory apparatus, etc. Thus it is that in the neuroses, and in particular in neurasthenia, it will often be necessary to practice intestinal antisepsis conformably to the rules which have been laid down under the head of "Dyspepsia and Dilatation of the Stomach."

Meningitis should be regarded as a microbic disease, capable of being produced by different microbes. Under the collective name meningitis are grouped all the divers inflammations of the meninges (pia mater and arachnoid) which are produced, especially in children, under the influence of various causes. We designate more particularly under the name *acute meningitis* the inflammation caused by a traumatism, sunstroke, excess of mental work, etc. We call the meningitis *secondary* when it is consecutive to a suppuration local or general, otorrhœa, otitis, caries of the cranial bones, erysipelas of the face, rheumatism, syphilis, pyæmia, endocarditis, pneu-

monia (pneumococcus-meningitis), eruptive fevers, typhoid fever. Lastly, *tuberculous meningitis* is the most grave of these affections of microbic origin. The clinical differentiation of these various forms is difficult to make from the onset, despite the importance of an accurate diagnosis from the point of view of prognosis. We know, in fact, that while tuberculous meningitis is almost always fatal, recovery from the other forms is by no means impossible. In the absence of the bacteriological examination, the practitioner will rely chiefly on the antecedent history and the commemorative signs. Moreover, the treatment of the different forms is nearly the same, and in this affection, as in pleurisy, success may be considered as the touchstone of diagnosis; in other words, *the meningites not tuberculous are alone curable.*

General Treatment.—The obstinate constipation should be earnestly combated. Calomel acts as a purgative and an antiseptic. Give every four hours a powder consisting of one-tenth of a grain of calomel with two grains of rhubarb; this treatment to be pursued till free purgation ensues. The iodide-of-potassium treatment has considerable repute. One grain of iodide of potassium is given three times a day in syrup and water. The *Sirop iodo-tannique* is a good form in which to give iodide of potassium to children.

℞ Iodine........................ ...... 2.0
Extract of rhatany 8.0
Sugar and water, q. s. to make 1 kilogramme of syrup.
M. Dose, a tablespoonful twice a day.

Dujardin-Beaumetz gives sulphate of quinine from the onset; he prefers the subcutaneous injections of bromhydrate of quinine (1.50 grammes in the twenty-four hours).

Antipyrine in grain doses to young infants acts as a calmative and antiseptic.

Intestinal antisepsis by means of naphthol or benzonaphthol may be indicated.

Local Treatment.—This treatment consists in the application of medicaments at once antiphlogistic and antiseptic to the shaved scalp. Revulsives are to be eschewed; the ice-bag is the preferable treatment. Cold has here a probable antiseptic action. Tartar-emetic ointment (Descroizilles) is of very doubtful efficacy. The same may be said of Roger's belladonna-mercurial ointment (mild mercurial ointment, 5 parts; ext. belladonna, 1 part), with which he makes inunctions to the scalp and behind the ears. There has lately been some good English testimony in favor of a similar use of iodoform ointment (10 to 25 per cent. of iodoform) applied to the shaved head.

CHAPTER VI.

THE ANTISEPTIC TREATMENT OF GENERAL INFECTIOUS DISEASES.

I shall include under the above head the following diseases: Smallpox and varicella, measles and rubella, scarlet fever, erysipelas, mumps, typhoid fever, typhus, epidemic cerebro-spinal meningitis, cholera, yellow fever, sweating sickness, influenza, canine rabies, tetanus, malaria, and syphilis.

VARIOLA AND VARICELLA.

We find in the pustules of variola, in the blood of the portal vein, and in the liver and kidney of individuals affected with this disease, microbes of several species (*Micrococcus*), and notably the *Pasteurella Hlavai*, the *Streptococcus pyogenes*, and the *St. variolæ* (Cohn). According to Pfeiffer, some of these pretended micrococci, which no one has yet succeeded in cultivating artificially, are sporozoa, similar to those of malaria. However this may be, the infectious nature (inoculable and contagious) of the disease is admitted by all authorities. The antiseptic treatment *intus* and *extra* is, then, formally indicated.

Internal Treatment.—General and intestinal antisepsis may be made with naphthol or betol, or with benzonaphthol, according to the indications.

In the secondary fever of suppuration of grave

confluent variola, M. Audhoui gives the following potion:

Phenic acid	1.0
Syrup of cinchona	30.0
Syrup of acacia	120.0

M. Dose, a tablespoonful every hour.

[This would be equivalent to about one grain of concentrated phenic acid every hour; the vehicle might be acacia syrup, flavored or not with wintergreen and other aromatics.—TR.]

In hæmorrhagic smallpox, M. Descroizilles gives sulphate of quinine in 2-grain doses every four hours. M. DuCastel gives full doses of perchloride of iron. Salicylic acid and salicylate of soda have also been given, and benzonaphthol when there was a complication of nephritis.*

Local or External Treatment.—The antiseptic treatment of the vesicles of smallpox presents a question of great importance, as much from the point of view of the general course of the affection, as from that of the cicatrices consecutive to the ulcerations of the derm.

---

* It will be seen that there is really no internal antiseptic treatment for variola that can much modify this disease.—TR.

Gueneau de Mussy counsels the following ointment:

Tannin Oxide of zinc	} ää	2.0
Calomel		0.25
Ext. opii		0.10
Simple cerate		30.0

For local application.

M. Descroizilles prescribes the following:

Collodion	40.0
Castor oil	4.0

M. For local application to the vesicles.

Or, in the more grave cases:

Glycerin	10.0
Soap	20.0
Ung. hydrarg.	40.0

M. For local application to the vesicles.

Corrosive-sublimate-vaselin (1 to 5 per cent.) may be applied to each pustule separately by means of a little pledget of wadding, the operation being repeated three times a day or even oftener.

Talamon has formulated much more precisely the treatment of smallpox pustules. This is his method: Make ethereal antiseptic pulverizations—with salol if the disease is mild, with corrosive sublimate if the eruption is *coherent-confluent* (not primarily confluent). There is no better spray-solution than the following:

Corrosive sublimate, Citric acid	ää..........	1 Gm.
Alcohol	....	5 c.c.
Ether	...............q. s. to make	50 c.c.

Spray with this solution three or four times a day to complete desiccation.

The duration of the sprayings is variable: it is customary to stop when the stratum of corrosive sublimate deposited begins to whiten the pustule (this result is obtained at the end of about a minute). In hæmorrhagic or *primarily confluent* smallpox these pulverizations are useless or contra-indicated, but they arrest the evolution of the vesicles in the abundant or coherent-confluent forms.

A quarter of an hour after the spraying, the nurse will cover the patient's face with a layer of the following ointment, using for this purpose a pledget of cotton-batting, and rubbing in briskly:

Corrosive sublimate................	1.0
Glycerite of starch.................	15.0

After the fourth day the nurse will make only two pulverizations a day, while continuing the application of the ointment as before. The sprayings to be discontinued on the sixth or seventh day.

When the crusts are detached, the physician will substitute for the glycerite-of-starch ointment, borated vaselin, and will give the patient sublimate baths (one ounce of corrosive sublimate being dissolved in the water of a full bath).

The eyes are frequently washed in warm boric water. The eruptions of the mouth and throat are treated by antiseptic irrigations and gargles frequently repeated. Every two hours the nurse will paint the mucous membrane of mouth and fauces with a mixture of equal parts of salol and glycerin.

Varicella, an attenuated form of variola, is to be treated according to the same principles, but with less rigor. Salol-vaselin or sublimate-vaselin will suffice to arrest the evolution of the vesicles and prevent any ulceration of the derm which might cause cicatrices.

I may remark here that vaccination has been employed with success at the very onset of smallpox, as a means of attenuating the manifestations of this disease, and notably the cutaneous eruption which is so dreaded on account of the consecutive cicatrices.

MEASLES AND RUBELLA.

The microbes which have been found in the papules and in the pulmonary secretions of measles have been described by Babes, and characterized under the name of *Streptococcus morbellosus* by Trévisan. More recently, LeBel found in the urine of children affected with measles a bacillus which he has been able to cultivate, but with which he could not inoculate animals as Babes had done with the streptococcus.

We know that this disease is grave only by reason of the pulmonary complications (bronchitis, pneu-

monia) which often accompany it. The treatment is that of the complications, which, rest in bed or in one's room, and careful hygienic measures, will generally ward off.

Dieulafoy treats malignant measles by baths at 26° C. (78° F.) for twelve minutes, with cold affusions on the head. These baths are repeated every four or five hours till the temperature falls to about 38.5° C. (101° F.), and till the secretion of urine is restored. The skin becomes supple, and the eruption grows paler but pursues its course.

Rubella (German measles) is an attenuated form of rubeola, and presents no special indications.

SCARLATINA.

The microbe considered as the producer of this disease is the *Perroncitoa scarlatinosa* (Trévisan), a transversal diplococcus, *i.e.*, with cells articulated two by two so as to form a double chain. At the same time, in grave cases we find constantly in the organs the *Streptococcus pyogenes;* and Cornil has been led to suppose, by reason of the constant presence of this micro-organism in the grave forms of exanthematous fevers, "that certain known pathogenic microbes, having acquired in particular conditions of environment a special virulence, have the faculty of producing the eruptive diseases." It is possible also that these diseases are constituted by *microbian associations.*

The antiseptic treatment has especially for its

object the benefit of the nephritic complication which is so frequent in this disease. The daily examination of the urine will be a useful guide.

M. Descroizilles gives carbonate of ammonia in grain doses in syrup and peppermint-water.

H. Roger, to combat the nephritis, prescribes the following potion:

Tannin......................	0.20 Gm.
Tinct. aconite................	10 drops.
Syrup of acacia..............	100 Gm.

M. Sig.: A dessertspoonful every two hours.

Paint over the region of the kidneys with tincture of iodine, or apply a flannel wrung out of hot water containing spirits of turpentine.

Give twice or three times a day a little sweet spirits of nitre with syrup of squills and digitalis:

℞	Spts. eth. nit.	f ʒ ij.
	Syrup. scillæ.....................	f ℥ iij.
	Tinct. digitalis..................	f ʒ j–ij.

M. Dose: A teaspoonful three times a day.

Fuchsin in capsules may render service, but it is necessary to insist on vapor baths, especially if there is anasarca, in order to make up for the renal insufficiency and favor the reëstablishment of the functions of the kidneys.

Scarlatinal angina is best treated by irrigations of borax or salol, or gargles of borax. Chlorate of potash in 2 to 5-grain doses is in very general use.

[Phenic acid sprays cannot be too highly recommended:

℞	Acid carbolic, fort.	2½ parts.
	Borax.	7 parts.
	Glycerin	10 parts.
	Lime-water.	90 parts.

For a common spray atomizer.—Tr.]

Milk diet from the onset often suffices to prevent renal complications. In grave cases, cold baths may be used, as recommended in the treatment of malignant rubeola.

ERYSIPELAS.

The microbe of this affection (*Streptococcus erysipelatis*) is probably only a variety of the *Streptococcus pyogenes*, the pus microbe. The cultures of the two microbes are identical.

The treatment of this disease should be both general and local.

The *local* or *external treatment* is the more important from the fact that it is possible by antiseptic dressings to localize the inflammation of the skin to the point first affected, and to trace in some sort a line of demarcation which in most cases will not be overleaped by this inflammation. We thus reduce an affection which only becomes grave by its extension, to the proportions of a simple phlegmon.

A great many antiseptics, notably phenic acid, corrosive sublimate, and salicylic acid, have been employed for this end.

Verneuil sprays the part with a 3-per-cent. phenic acid solution.

Hallopeau employs salicylic acid (solution $\frac{2}{6}$) or salicylate of soda. A mask of linen cloth folded in several thicknesses is soaked in a solution of the sodium salicylate ($\frac{1}{60}$) and applied to the face or other part affected; this is covered with oiled silk to prevent evaporation. The result is very satisfactory; the swelling and tension of the skin diminish and disappear, and, even when the eruption spreads beyond the mask, the pain is much less great and the cerebral symptoms much less intense.

Talamon sprays the following solution over the limiting zone of the erysipelas and a little beyond the swelling, the procedure lasting one minute:

Hydrarg. bichlorid. Acid. tartaric.	} āā	.... 1 Gm.
Alcohol	....	5 c.c.
Sulphuric ether	......q. s. to make	100 c.c.

This solution being caustic, it is necessary to protect the eyes, nares, and lips. These pulverizations should be repeated two or three times a day. Employed from the beginning, this treatment will bring on resolution by the fourth day.

In cases of feeble intensity, the medical attendant will content himself with dressings of salicylate of bismuth in powder (Marc Sée).

Internally sulphate of quinine and salicylate of soda may be given alternately, with a day of interval

between, or salicylic acid may be administered in doses of 20 grains three times a day, provided there are no cerebral accidents or dyspnœa.

As general antiseptics, naphthol and benzonaphthol may render service in this disease.

MUMPS.

By its epidemic and contagious nature, and its mode of evolution, this disease resembles the eruptive fevers, and must be regarded as an *infectious parotiditis*, produced by a special microbe which has not yet been isolated.

Bouchard gives the following potion:

Phenic acid........................	0.50
Sulphate of quinine, Salicylic acid } ää...........	2.0
Rum............................	125.0

M. Dose: A tablespoonful every hour till all is taken.*

Emollient applications of camphorated oil or glycerite of starch, with the addition of opium as there seems to be indication, suffice for the external treatment.

TYPHOID FEVER.

The microbe of this disease is probably the *Bacillus typhosus* of Eberth.

There are few diseases in which rigorous intes-

---

* These doses seem unnecessarily large in so mild a complaint as mumps.—Tr.

tinal antisepsis is more plainly suggested, by reason of the ulcerations which are seated in the walls of the intestine.

According to Bouchard, there are four indications to fulfill: general antisepsis, intestinal antisepsis, antipyretic medication, lastly regimen. He begins by a saline purgative; then gives calomel—in the dose of 40 centigrammes (about six grains) a day, in twenty doses—for four days, taking care to avoid salivation. He gives quinine only when the temperature exceeds 104° F. in the morning and 105° F. in the evening; then he gives 2 grammes (30 grains) daily during the first and second week, then 1½ grammes (22 grains) during the third, then 1 gramme (15 grains) only, taking care not to give another dose till after seventy-two hours. General baths at 38° C. (100° F.), cooled by degrees down to 30° C. (86° F.), and repeated eight times in the twenty-four hours, are only contra-indicated when there is intestinal hæmorrhage or pulmonary hepatization. Beef peptones for nourishment, and glycerin (six to seven ounces per day). Vegetable acids under the form of lemon-juice.

For intestinal antisepsis, Bouchard prefers naphthol α, which he administers under the following form:

$$\left.\begin{array}{l}\text{Naphthol } \alpha \\ \text{Salicylate of bismuth}\end{array}\right\} \text{ää 5 Gm.}$$

M. Div. in chart. No. x. Sig.: Take one powder every hour.

Benzonaphthol, recently introduced into therapeutics, may be substituted with advantage for naphthol, especially if the kidneys functionate badly. In the latter case, it is well also to avoid salicylate of bismuth.

Dujardin-Beaumetz has long employed the bisulphide of carbon as an intestinal antiseptic in typhoid fever. He now prefers beta-naphthol, betol, and benzonaphthol.

Jaccoud employs alcohol associated with extract of cinchona, and, occasionally, acetate of ammonia. In the most grave cases he gives hydrobromate of quinine, 7½ grains every quarter of an hour till four doses are taken, beginning eight hours before the febrile exacerbation.

Hertz prescribes salol associated with salicylate of bismuth, in the dose of 4 grammes (ʒ j) a day.

TYPHUS FEVER.

Typhus exanthematicus appears to be produced by a specific *streptobacillus* studied by Hlava, and which is found in the blood, not in the organs.

This disease, rare in France, is treated conformably to the rules of internal and general antisepsis: evacuants at the onset, then quinine, alcohol, naphthol, and benzonaphthol.

EPIDEMIC CEREBRO-SPINAL MENINGITIS.

By its course and its epidemic nature this disease resembles the general infectious diseases. The mi-

crobes of various species met with at the autopsies have been studied by Cornil and Babes, and by Leyden. The species most frequently found is the lanceolated microbe of Pasteur.

The antiseptic treatment does not differ from that of meningitis, apart from the symptomatic and prophylactic indications proper to epidemic meningitis.

General antisepsis may be carried out.

CHOLERA.

This disease is produced by the *Spirillum choleræ Asiaticæ* of Fluegge, designated by Koch under the name of *comma bacillus.*

Hayem considers the lack of acidity of the gastric juice as one of the principal predisposing causes of the disease, and prescribes lactic acid in doses of four to six grammes (ʒ j–jss) a day as a prophylactic means, and in doses of ten to twenty grammes (ʒ ijss–v) as a curative measure when the disease is declared. In bad cases he makes intravenous injections of common salt 175 grains, with 150 grains of sulphate of soda, to the quart of distilled water.

The new antiseptics, naphthol, betol, salol, benzonaphthol, have not yet been tried, at least in France.

The tonic and supporting treatment is still as necessary as ever.

In cholera infantum (which seems to be due to a microbe different from that of Asiatic cholera) Jules Simon prescribes the following potion:

℞	Salicylate of bismuth.................	4.0
	Prepared chalk.......................	2.0
	Tinct. canella........................	1.0
	Peppermint-water.....................	10.0
	Malaga wine................. 10.0 to	30.0
	Syrup acacia............... 100.0 to	120.0
	Paregoric elixir.	10 drops.
M.		

The dose of the above would be a teaspoonful every hour.

YELLOW FEVER.

This disease is produced by the *Bacillus amaryllæ* (Trévisan), which has been studied by Cornil and Babes, and is found in the liver and kidneys of persons affected with this disease.

Yellow fever ought to be treated according to the rules of intestinal antisepsis in general. Purgatives, acidulous and gaseous drinks (champagne), quinine, etc., are the means thus far employed to combat this affection.

THE SWEATING SICKNESS.

This disease, still incompletely studied, epidemic but not contagious (?), is probably of microbic origin. It is quite common in certain regions of France, where it is associated with the eruptive and malarial fevers. Cold lotions, tonics, quinine, and ipecac, are the means thus far employed; repeated cold-water lotions, vinous lemonade, sulphate of quinine, dry cups to relieve the oppression.

The specific microbe of influenza was described first by Babes, then by Seifert, and more recently by Pfeiffer. It is the *Streptococcus Seiferti*, and much resembles the *Streptococcus pyogenes*, according to Babes, but ought to be considered as a true bacillus. It is found almost always associated with the *Staphylococcus aureus* and the *pneumococcus*, in the sputa of patients affected with the "grip."

Dujardin-Beaumetz recommends the following treatment:

Neuralgic Form.—Give analgesin or exalgin in rum or some other alcoholic potion, in the dose of two to three grammes per day. Or give phenacetin in capsules of 15 grains twice a day.

Gastro-intestinal Form.—Here the reliance must be on preparations of opium, *e.g.*, paregoric in 10-drop doses three times a day—constipation and diarrhœa being combated by appropriate laxatives or antiseptics (salicylate of bismuth, betol, naphthol, benzonaphthol).

Catarrhal Form.—Give 5 grains of quinine morning and evening; this may be associated with 15 grains of analgesin or 10 of phenacetin. The dose of quinine may be varied from five grains to twenty grains.

Aconite is sometimes useful in the acute attack. One or two drops may be combined with a fluid-drachm each of syrup of Tolu and cherry-laurel water,

and given every four hours. If the patient is much depressed, make subcutaneous injection of caffeine twice or three times a day:

Caffeine Benzoate of soda	} ää................	2.50 Gm.
Distilled water	..........q. s. to make	10 c.c.

M. [Each syringeful contains 0.25 of caffeine.]

CANINE RABIES.

The specific microbe of this disease is not yet known, nor does there seem to be any general antiseptic treatment. The inoculation of the virus attenuated by culture, according to Pasteur's method, is the sole method of cure yet recognized. The local treatment of the wound consists in cauterizing it with the hot iron; the chemical caustics are insufficient. The excision of a considerable portion of the soft parts bitten (skin, connective tissue, muscles) may be demanded.

TETANUS.

This affection seems to be due to the presence in the blood of the microbe (*Pacinia*) of Nicolaier, of which the germs are found habitually in vegetable mould. The inoculation takes place under the skin by a solution of continuity often almost invisible.

According to the recent researches of Vaillard and Vincent,* this bacillus acts by a very active toxine similar to that of the microbe of diphtheria, *i.e.*, having

* Annales de l'Institut Pasteur, 1891.

the chemical characters of the diastases. It is a poison at first muscular, then having an elective localization in the spinal cord.

According to experiments made by these two observers, it is noteworthy that the bacillus does not seem capable of itself of producing tetanus; it needs besides a predisposing condition, such as a traumatism, the presence of lactic acid, or of another microbe, such as the *Microbacillus prodigiosus.* Now several species of microbes abound in the soil.

The presence, in the tissues, of lactic acid and the toxine peculiar to the microbe, destroys phagocytosis, which in the physiological state can of itself prevent the disease, as the leucocytes engulf the microbes and their spores and annihilate their toxic products (Vaillard and Vincent).

In accordance with the etiology of this disease, we see the importance of seeking, at the very onset of the accidents, for the least solutions of continuity of the derm, and of treating them by the local antiseptics. The antiseptic dressing of accidental or operative wounds, to-day practiced by the majority of physicians and surgeons, ordinarily guarantees the patient against this complication. [The treatment of tetanus by subcutaneous injection of blood-serum from animals immune to the disease, has given some encouraging results. This serum contains certain antitoxines which have in numerous instances proved curative when the disease has been fully established.

Schwartz, in *La Semaine Médicale* for April 5, 1893, reports two cases recently occurring that seemed to owe their recovery to these injections. An injection of 50 c. c. of the serum is a medium injection. This treatment, under proper antiseptic precautions, seems to be safe.—Tr.]

MALARIA.

The intermittent or marsh fevers have for their causative factor a micro-organism which, unlike most other pathogenic micobes, is not a vegetal of the family of bacteria, but an animalcule of the group of *Sporozoa*, designated under the names of *Hæmogregarina malariæ*, *Hæmatophyllum malariæ*, or *Laverania malariæ*, the latter name being given in honor of M. Laveran, who first discovered the parasite in the blood of malarial patients.

The antiseptic which is justly regarded as specific in this disease is quinine.

In the quotidian form the quinine ought to be so administered that the last dose shall have been given eight hours before the expected chill; hence it is convenient to begin the administration almost immediately after the preceding chill. This is Jaccoud's method.

In the tertian form, give the quinine twelve hours before the time for the chill.

In quartan ague, give it fifteen to eighteen hours beforehand.

The elimination of the remedy being rapid, you must bring near together the periods of administration of the fractions of the full dose required, in order to keep the organism well under the influence of the drug. If you decide that 15 grains is sufficient, you will give this quantity in three or four equal doses an hour apart.

Large doses (30 grains or more) are often necessary to bring about suppression of the attacks; this being accomplished, the doses can be reduced so that the daily quantity shall not exceed twelve grains, for a number of days.

In grave cases, when the stomach will not tolerate the medicine, you can give hypodermatic injections of quinine hydrobromate. Dissolve one part in five parts of distilled water, thus:

℞	Hydrobromate of quinine............	1.0
	Distilled water..................	5.0

M. Three or four injections per day.

The preparations of cinchona, and arsenic and its salts, are principally used in the chronic forms of malaria.

SYPHILIS.

This disease, infectious, contagious, and inoculable by way of wounds of every kind, is considered as produced by the presence in the blood, and consecutively in the cellulo-vascular tissue and the bones, of the bacillus discovered by Lustgarten, the *Pacinia*

syphilitica, a microbe whose specificity remains doubtful.

Save in congenital (hereditary) syphilis, it is admitted to-day that the starting-point of the syphilitic infection is always an inoculation of which the initial lesion is the indurated or infectant chancre. The soft (or simple) chancre does not give constitutional syphilis – which amounts to saying that it does not contain the specific bacillus of this affection, although it is equally of infectious or microbian nature. The microbe or microbes which produce it have not yet been sufficiently studied. It is probable that several species, notably those of pus, are associated here.

Local Treatment.—Whether we have to do with the simple chancre, or with the hard infectant chancre, the local antiseptic treatment is nearly the same.

Ricord employed the nitrate of silver (solution $\frac{1}{30}$), which brings about a cure in twenty-five to thirty days.

Iodoform may be expected to cure the chancre in about a week.

Salicylic acid is said to be still more active (Hebra). It is said to bring on cicatrization in four or five days. It is employed in fine powder, and covered with a thin layer of wadding. It should be renewed once or twice a day following the suppuration, and the sore washed every time.

Hot water, recommended by Aubert, of Lyons, under the form of prolonged baths (several hours), suffices in most cases.

Here are a few formulæ of ointments employed especially in indurated chancre:

℞	Iodoform	1.0
	Balsam of Peru	3.0
	Vaselin	8.0

M. For dressings. (Dujardin-Beaumetz.)

℞	Calomel, Oxide of zinc ää	2.0
	Lanolin, Vaselin ää	15.0

M. For dressings. (Mauriac.)

If the chancre is *phagedenic*, you will, after having removed the scabs, dress it three times a day with wadding coated with:

Calomel	2.0
Cold-cream ointment	20.0

Or once a day with the following ointment:

Pyrogallic acid	5.0 to 10.0
Vaselin	50.0

Or with the following when the sore granulates abundantly:

Chloral	1.0
Water	100.0

M. Sig.: To be used once a day as a lotion to the venereal ulcer. Powder the sore afterwards with sub-carbonate of iron.

Terrillon also employs pyrogallic acid in phagedenic chancre:

℞	Pyrogallic acid	10.0
	Starch powder	40.0
M	For dressings.	

According to M. Du Castel, the indurated chancre gets well of itself in a given lapse of time, and the local treatment has a rôle which is rather hygienic and prophylactic than curative. Instead of the irritant topical applications, he proposes powders of salol or cinchona.

Resorcin, corrosive sublimate, or phenic acid may be employed, according to the indications. It is sometimes advantageous to paint with the following solution:

Alcohol	20.0
Phenic acid	2.0

One painting a day for three or four days, rapidly transforms the chancre into a simple wound. Follow with a dressing of salol or aromatic wine.

General or Internal Treatment of Confirmed Syphilis.—This treatment is based on the employment of mercury or its salts, which have here an efficacy such that we may regard them as specifics. Iodine and the iodides are often associated or alternated with mercury.

Dujardin-Beaumetz has advised hypodermatic injections of chloropeptonate of mercury:

Peptone in powder Pure chloride of ammonium	ää..	0.3
Corrosive sublimate...............		0.2
Glycerin...........................		5.0
Water		15.0

M. [Each syringeful contains 1 centigramme of corrosive sublimate.] One injection every day or every two or three days.

Mauriac gives protoiodide in pills. Each pill contains one-half a grain of protoiodide of mercury, with one grain of quinine; three of these pills may be given daily.

The following syrup also is Mauriac's:

Biniodide of mercury...............	0.1
Iodide of potassium............	5.0 to 20.0
Syrup aurantii cort.................	200.0

M. Dose: Two to three tablespoonfuls a day.

Give the maximum of the iodide in ulcerous syphilis.

Fournier remains faithful to the mode of administration of mercury by the skin, under the form of frictions of mercurial ointment. He begins by rubbing in 4 grammes (ʒ j) a day, and increases gradually to 8 grammes (ʒ ij). Women and especially children are most sensitive to these inunctions; in the latter, in the course of the first year, one to two grammes (15 to 30 grains) a day will suffice. The

ointment is left in place eight to ten hours, covered with wadding and sticking-plaster; at the end of this time the region is washed with soap and water. The treatment is continued uninterruptedly three or four weeks.

Baths of corrosive sublimate, mercurial fumigations, etc., have also been employed in syphilis.

There are three periods in the systematic treatment of syphilis: *First*, that of local treatment of the chancres and buboes, if there are any; *second*, that of the mercurial treatment properly so called; (in the period of transition, the iodides and mercury are associated); *third* (tertiary period), that of iodide treatment alone.

The treatment of constitutional syphilis demands often three or four years. During this long space of time the prudent practitioner will institute the method of successive treatments, according to the directions of Fournier, with its stages of repose, called periods of *accustomance*.

CHAPTER VII.

ANTISEPTIC TREATMENT OF DISEASES OF THE SKIN.

General Considerations on the Nature of the Dermatoses.—A great number of cutaneous affections are directly produced by parasites, animal or vegetable, the destruction of which is the first therapeutic indication.

Among the first are the various forms of itch and phthiriasis, produced by arthropoda (acari or insects); then the *psorospermoses* (epithelioma and Molluscum Contagiosum, eczema of Paget, carcinoma, etc.), which appear to be due to the presence of animalculæ of the sub-kingdom Protozoa and of the class of Sporozoa (coccidia, etc.).

Among the second, we may place the *dermatomycoses*, affections produced by microscopic fungi of an order more elevated than the bacteria. Such are tinea favosa, tinea tonsurans, pityriasis capitis, porrigo decalvans, etc.

Other affections of the skin are considered as cutaneous manifestations of certain infectious or microbic diseases. Besides erysipelas, smallpox, measles, etc., which belong to general diseases, we may mention lepra, elephantiasis, lupus (produced by the *Bacillus tuberculosis*), the disease recently described under

the name of *perlèche*, furuncle, anthrax, the cutaneous manifestations of syphilis, etc.

In a large number of cutaneous eruptions, investigators have noticed the presence of bacteria of various species. Vidal has noted them in the pustules of ecthyma; Vidal and Gebier in the bullæ of pemphigus; Eklund and Lang in psoriasis; Babes in the pustules of prurigo. The latter is due to a streptococcus of particular species (*St. giganteus cutis*). In the sweat of the feet and of the armpits are found microbes considered as simply saprogenous, and not pathogenic like the preceding.

We know to-day that the cutaneous follicles, aside from any and every traumatic solution of continuity, may serve as a door of entrance to pathogenic bacteria whose germs float in the air and adhere to the garments or fingers. The fact has been proved experimentally in the case of furuncle. In all cases, scratching, the friction of the garments, and every irritant contact which inflames the skin, more particularly over the hair follicles, contribute to facilitate the inoculation of pathogenic microbes.

Even when this inoculation is not the immediate cause of a cutaneous eruption, and when we are obliged to seek for a double point of departure of the latter—both in a constitutional dyscrasia and in a local irritation purely traumatic—it is necessary to guard against the complications due to the presence of microbes, and particularly those that always ac-

company suppuratious (*Streptococcus pyogenes* and *Staphylococcus pyogenes*).

Every pimple is a weak point where the inflamed skin loses its protective epithelial covering, and may become a door of entrance for the pyogenic microbes. Moreover, when these pimples (papules, vesicles, pustules) communicate more or less freely with the exterior by suppuration or by the simple serous exudation which accompanies the cutaneous œdema, they become veritable foci of microbic cultures. These bacterial cultures are the principal obstacle to the cure, for they foster the local phagocytosis and diapedesis, and oppose the cicatrization and *restitutio ad integrum* of the epithelial coat.

These considerations suffice to explain why the local antiseptic treatment is so obligatory in most diseases of the skin, and why the other treatments remain inefficacious when this is neglected.

A general antiseptic treatment must also be carried out. We know the strict relations which exist between the functions of the mucosa of the gastro-intestinal tube and the functions of the skin; a great number of the cutaneous affections have their starting-point in lesions of nutrition (superabundant diet, alcoholism, renal lithiasis, diabetes, constipation, dyspepsia). In all these cases there will be occasion to effect general and intestinal antisepsis by the aid of naphthol, benzonaphthol, etc.

In the following review of the applications of

antiseptic therapeutics to the dermatoses, I shall be obliged to be brief, and shall give but a small number of formulæ. I shall begin by saying a few words about the treatment of wounds and burns, omitting the indications which belong particularly to the department of the surgeon.

WOUNDS AND BURNS.

Burns, cuts, and solutions of continuity of the derm may, when of little extent, heal by first intention without suture and without ligature. To aid in this process, we employ adhesive plasters and collodion. Perfect cleanliness is the first requisite; asepsis at the first insures ultimate antisepsis. The wound is first washed with boiled water or boric or carbolic water, and the physician will use, not a sponge which may be foul, but a wad of antiseptic absorbent cotton. Every foreign body must be removed from the wound. Diachylon plaster should be eschewed; it is never fresh and is likely to be septic, besides it is irritating to the wound and to the skin. The English *emplastrum adhesivum* is not much better, and certainly adheres badly. The ricinated collodion, the collodion-goldbeater's skin, the gummed collodion and isinglass plasters, the artificial *baudruche*, are more useful. Flexible or ricinated collodion, alone or with the addition of iodoform or salol, is employed in the form of an ethereal solution which is easily painted over the part with a camel's-hair pencil. On the

evaporation of the ether it forms a thin, firm pellicle which adheres with much tenacity to the part and makes an admirable protective coat; it cannot easily be washed off with water, hot or cold. The gold-beater's skin and isinglass plasters make also an excellent agglutinative dressing; they may be applied dry to the skin which has been moistened with an aseptic liquid, and several layers of collodion may then be painted over the dressing to render it more resistant.

The old-fashioned treatment of burns by carron oil and cotton batting is liable to cause extensive suppurations and vicious cicatrices. The cotton batting sticks to the tissues and is not easy of removal, and, unless it be made antiseptic by corrosive sublimate or iodoform, is almost sure to entail suppuration. With the transparent *baudruche* (gold-beaters' skin) there is nothing of this kind to fear. Phlyctenæ are to be punctured and covered with isinglass plaster. In numerous cases of burns of the face I have obtained excellent results in this way. A favorite method of treating extensive burns involving destruction of the epidermis, is by means of borated vaselin applied on strips of linen or gauze. Wall's ointment consists of 1 part cocaine, 16 parts salol, and 120 parts vaselin. The seat of the injury is first irrigated with boric water or Van Swieten's solution diluted with as much boiled water.

FORMS OF APPLICATION OF TOPICAL AGENTS IN DISEASES OF THE SKIN.

Since the good effects of antiseptic therapeutics have been recognized, fats of animal origin (lard and benzoated lard), which quickly become rancid, have been almost universally abandoned, being replaced by vaselin, glycerites, and glyceroles—chemical compounds of the same consistence, but with the advantage of not becoming rancid. Oils of vegetable origin ought to be sterilized, or replaced by products which, like retinol, are antiseptics of themselves and may serve as excipients to a great many active substances.

In many cases it is better to apply the topical agent in the form of a fine powder (calomel, iodoform, dermatol, etc.).

Lastly, in desperate cases, it is well to have recourse to sprays of antiseptic liquids. M. Besnier employs pulverizations (by means of a hand-atomizer) of corrosive sublimate, 1 to 1000, in eczemas and other dermatoses that have resisted all other forms of treatment.

ERYTHEMA.

In simple erythema we employ astringent lotions and dust the parts with absorbent powders. Tar ointments, oil of cade, calomel ointment, etc., are much used In children's *intertrigo* we employ mixtures of powder of talc and oxide of zinc, or boric acid and starch. In erythema nodosum, Vidal coun-

sels lotions of ammonium chloride (1:20), and gives internally quinine or salicylate of soda.

ECZEMA.

In acute cases use salicylic-acid or oxide-of-zinc ointment with starch and lanolin. Brocq recommends a mixture of absorbent powders—oxide of zinc, bismuth subnitrate, starch—and ointments of boric acid, balsam of Peru, oil of cade, or yellow precipitate, according to the indications. The internal treatment will be that of the cause (salicylate of soda, of lithia, etc.).

Eczema of the anus demands paintings with nitrate of silver, with chloral, etc. If dry, it may be treated with a mixture of tannin and calomel in glycerite of starch.

Eczema of the beard is treated with ointments of precipitated sulphur, turpeth mineral, etc.; if there is sycosis, a plaster formed of a mixture of minium and cinnabar is employed.

In eczema of the face, Besnier employs a mixture of glycerite of starch with tartaric and salicylic acids, or subacetate of lead.

In eczema of the genitals, he uses an ointment of hydrated sulphide of zinc. Vidal introduces into the vagina a tampon soaked in gurjun oil and lime-water.

In chronic eczema, tannin, alum, subacetate of lead, sulphate of zinc, binoxide of mercury, and cor-

rosive sublimate (1 to 2 per 100) have been successively employed.

HERPES.

Fournier recommends the following powder:

Subnitrate of bismuth	....	4 parts.
Calomel, Oxide of zinc	ää..................	1 part.

M.

In *herpes iris*, Vidal employs for the buccal mucosa a collutorium of borax dissolved in glycerin and cherry-laurel water. To the mucous membrane of the eye he applies a warm and very dilute solution of Goulard's extract.

In genital herpes, if dry, lanolin and vaselin are used. If the herpes is moist, a powder is advised consisting of 1 part bismuth, 5 parts tannin, and 100 parts powdered starch; or the glycerite of tannin (1 part tannin to 40 of glycerin).

SCABIES: THE ITCH.

The treatment of this parasitic disease is well known; the acarus (*Sarcoptes*) which burrows in the derm must be killed by ointments of sulphur and carbonate of potash, salol oil, vaselin, and naphthol β, with ether added to dissolve the naphthol. Descroizilles uses lotions of zinc chloride; Constantin Paul, petroleum soap; Vidal, oil of styrax.

Before using ointments, see that the epidermis is softened by thorough scrubbing with soap and water.

PEMPHIGUS.

This disease is one of those that need internal treatment, and especially tonics (arseniate of iron, etc.). Evacuate the liquid of the bullæ with an aseptic needle, and dress with powdered cinchona bark or with salol, iodoform, dermatol, etc. If the ulcerations are exposed, dress, like burns, with liniment of lime-water and linseed oil, and cover with *baudruche* or antiseptic gauze.

RUPIA.

With the shedding of the crusts obtained by emollients, the medical attendant may have occasion to resort to the antiseptic caustics (nitrate of silver, acid nitrate of mercury) and ointments of protoiodide or biniodide of mercury to prevent the crusts from re-forming. The antiseptic dressing is here imperative. If the affection is syphilitic, give internally one of the iodides of mercury.

ACNE.

In the different forms of acne, we employ, according to the case, ointments of sulphur and naphthol, baths and lotions of sulphide of potassium, ichthyol (which acts as a siccative and by the sulphur which it contains), zinc oxide, salicylic acid, ammonium chloride, mercurous iodide (emplastrum Vigo), solutions of corrosive sublimate (Brocq and Besnier). Internal treatment is indispensable, as acne of the

face almost always comes from an affection of the stomach.

IMPETIGO.

Remove the crusts by emollients, and apply an ointment of glycerite of starch and boric acid.

When the acute stage is passed, employ a glycerole with tannin and calomel, or plasters with oil of cade and yellow precipitate, minium or cinnabar. This latter dressing, removed each day, is preceded by a lotion of camphorated alcohol diluted with water.

PRURIGO.

M. Besnier treats this affection with lotions o warm water medicated with a little aromatic vinegar and phenic acid. The part is then dusted with a powder of salicylate of bismuth and starch.

Gaucher applies lotions of chloral, phenic acid, corrosive sublimate. Quinquaud employs acids: crystallized acetic acid (1 to 2 per 100), monochlor-acetic acid (15 per 100).

Pruritus vulvæ may be combated by solutions of borax and morphine, by applications of powders of bismuth subnitrate and belladonna, or by lotions of corrosive sublimate.

ECTHYMA.

M. Vidal employs a mixture of cinnabar 1 part, minium 2 parts, diachylon 27 parts. This topical agent is very promptly siccative and promotes cicatri-

zation; at the same time it prevents the disease from spreading.

LICHEN.

Besnier treats this affection with hypodermatic injections of arseniate of soda very dilute and thrown deeply into the muscles.

Hardy gives arsenic internally, and employs ointments of oxide of zinc and camphor, or calomel and tannin, or, sometimes, of cyanide of potassium (one grain to an ounce of vaselin), to relieve the itching.

Vidal uses inunctions of oil of cade or glycerole of tartaric acid.

PSORIASIS.

Besnier employs a naphthol ointment, or frictions with a mixture of pyrogallic and salicylic acids dissolved in ether and alcohol.

It is possible to get rid of the diseased skin by baths and frictions; then the parts may be brushed over with a camel's-hair pencil charged with a solution of chrysophanic acid in chloroform (15 per 100), and the surface covered with gutta-percha dissolved in chloroform.

In buccal psoriasis, iodoform is employed in ointment with cacao butter. Pomades of ergotin, calomel, oil of cade, and mercurial ointment are also employed. In children, Simon prescribes arseniate of soda internally in chronic cases.

ICHTHYOSIS.

Descroizilles prescribes baths with starch, vapor baths, inunctions with glycerite of starch, and frictions with tar and vaselin (1 to 2 per 100) or oil of cade and sweet almonds. Lotions twice daily with glycerin and water (1 per 10).

DERMATOSES CAUSED BY MICROPHYTES OR PARASITIC FUNGI.

We know that tinea favosa is caused by the *Achorion Schoenleinii;* herpes circinatus or tinea tonsurans by the *Tricophyton tonsurans;* pityriasis versicolor by the *Microsporon furfur;* pityriasis simplex by the *Microsporon Malassezii;* porrigo decalvans by the *Microsporon Audouini.* All these microscopic fungi are of an organization more complex and more elevated than the bacteria. Their destruction demands a very energetic antiseptic treatment.

Tinea favosa, like tinea tonsurans or tricophyton, is very contagious and very difficult to eradicate; it demands a long and persevering treatment, whose first indication is to keep the hair clipped close with the scissors in order that the necessary antiseptics may be very thoroughly applied. Epilation is necessary around the patches.

Besnier employs lavages with black soap or tar, boric acid, sulphur and salicylic acid, etc.; then he treats the patches with *emplastrum de Vigo.*

Brocq employs sublimate lotions (1 per 400 of

water and 100 of glycerin). Morning and evening he makes frictions with turpeth-mineral ointment.

Luillier employs a mixture of corrosive sublimate and sal ammoniac in solution (Gowland's liquid).

Quinquaud, without practicing epilation, makes use of solutions of corrosive sublimate, and of biniodide and bichloride of mercury associated.

Vidal employs turpentine and tincture of iodine.

In herpes circinatus and sycosis, tincture of iodine and turpeth mineral are the agents most often used.

Pityriasis versicolor is treated by Besnier with an ointment made of sulphur, resorcin, and salicylic acid, applied each evening and removed in the morning. He sometimes resorts to corrosive sublimate.

Gaucher employs salicylate of soda and chloral in lotions. Vidal, turpeth mineral in ointment with castor oil and cacao butter. Dujardin-Beaumetz treats pityriasis of the hairy scalp with inunctions of the following:

Glycerin } New rum } ää	50.0
Tincture cantharides	10.0
Saturated solution of borax	1000.0

Besnier prescribes a decoction of saponaria or of quillaya applied in the form of a lather.

Gaucher applies a solution of chloral.

Porrigo decalvans may be treated with decoction of Panama wood, frictions being also made with such substances as acetic acid and chloroform, tincture of cantharides, iodized chloroform, hydrochloric acid, essence of turpentine, ammonia, etc.

CHAPTER VIII.

THE ANTISEPTIC TREATMENT OF THE DISEASES OF THE EYES.

Aside from the operations practiced on the eyes, and which can only be performed by trained specialists, there are certain superficial affections of these organs (conjunctivitis, blepharitis, etc.) which belong to every-day practice, and which every physician ought to know how to treat conformably to the rules of modern therapeutics. Most of these affections being of infectious and microbian origin, the antiseptics are here unmistakably indicated. Before stating the special treatment of these affections, I shall say a few words concerning certain antiseptics considered in a general manner from the point of view of ophthalmology.

General Considerations.—The 4-per-cent. solution of *boric acid* is most widely in use, but it is not the most efficacious of the antiseptics. Its absolute innocuousness is the only advantage which it possesses. But if from a wholly hygienic point of view it has some utility, we may say without hesitation that when the physician has to do with a conjunctivitis of any sort (conjunctivitis of new-born infants, purulent or even catarrhal conjunctivitis of moderate intensity) its antiseptic action is absolutely inappreciable and altogether insufficient, and that its employment really

constitutes a danger, in giving to the patient a false sense of security, and causing him to lose precious time while the affection spreads and passes to a chronic stage. It would be better far to consult a good specialist who would prescribe from the first an antiseptic treatment proportioned to the gravity of the affection.

These reservations being made, the saturated solution of boric acid (4-per-cent.), prepared with filtered and boiled water, may be employed preferably in hyperæmic conjunctivitis, in catarrhal conjunctivitis of feeble intensity (while watching with care the secretion), and in phlyctenular conjunctivitis (concurrently with the appropriate medication, *i. e.*, ointment of yellow oxide of mercury, 3 grains to the ounce). In all cases the practitioner will make use of a cold solution with which to wet his compresses, which must be applied to the half-opened eyes five or six times a day. Compresses soaked in the same solution *warm* should be employed in all forms of keratitis uncomplicated with infectious ulcerations and blepharitis.

Lastly, this solution may serve for eye-dressings after the section of the cornea in iridectomy, whenever there is reason to dread the dangers of corrosive sublimate solution (such as infiltration of the cornea—a rare accident which has been referred, but perhaps not with sufficient reason, to the use of mercurial collyria).

Surgical instruments, previously rendered aseptic

by soaking in alcohol or strong carbolic acid (substances which might irritate the eye in the course of an operation), may be kept in the boric solution prior to and during a surgical operation on the eye.

The solutions of *corrosive sublimate* used in ocular therapeutics ought always to be prepared with distilled water alone, without the addition of alcohol (a condition indispensable in order that this solution may be non-irritant, and in order to avoid infiltrations of the cornea). The solution most commonly employed is 1:2000. Ophthalmologists use it for wetting compresses to be applied in the same manner as the boric solution, in the ophthalmia of new-born infants, in purulent conjunctivitis, in intense catarrhal conjunctivits with muco-purulent secretion, in infectious ulcers of the cornea, in granular conjunctivitis, etc. You will watch the employment of this solution, and if any ill effects should appear on the part of the skin or cornea, you will dilute it with a third or half as much water; you will thus obtain a solution which, while being absolutely harmless, loses (it must be owned) the largest part of its antiseptic properties. The solution of corrosive sublimate is also employed in lavages and irrigations to remove the pus of the inflamed conjunctiva, and to render aseptic the field of operation in iridectomy, etc. Surgeons now use this same solution to moisten the little gauze balls which are employed instead of sponges during operations.

The solution of corrosive sublimate, on account of tarnishing the metals, cannot be used to disinfect instruments used in operations.

A solution of 1 to 500 is employed during curettage of the conjunctival granulations in trachoma.

Bear in mind that when you have recourse to anæsthesia of the eye by cocaine, you must drop in the anæsthetic before medicating the eye with the sublimate solution, for without this precaution the action of the cocaine will be considerably lessened.

Phenic acid (1 : 125) is also employed as a feeble antiseptic in place of boric acid. Surgical instruments prior to an eye operation may be kept in a strong solution (25 to 50 per 1000), as in general surgery.

Biniodide of mercury, prepared according to the following formula:

Biniodide of mercury	0.05
Alcohol.........................	20.00
Water..........................	1000.00

is an antiseptic in general use, and one of the best for lavages, irrigations, disinfection of instruments, etc.

Cyanide of mercury in a $\frac{1}{100}$ alcoholic solution may serve for the disinfection of instruments; but as the eye tolerates alcohol very badly, the instruments must subsequently be soaked in a boric acid solution.

Iodoform and aristol in powder or ointment (1 : 10) are employed in the treatment of ulcers of the cornea.

It remains to speak of nitrate of silver, which, although it is considered by most ophthalmologists rather as a caustic than as an antiseptic, none the less occupies the first rank in the therapeutics of eye affections. Moreover, it is a fact that, because of their action on the microbes, the caustics ought to be classed among the most energetic antiseptics.

In dealing with conjunctivitis in general, the antiseptic treatment such as has been above indicated is in reality insufficient, or can be considered only as preventive. It is necessary to add cauterizations, sometimes twice a day, with a solution of nitrate of silver (2:100). In the less grave cases these cauterizations may be resorted to at longer intervals—every two days—or they may be made oftener with weaker solutions, as 1-per-cent. or ½-per-cent.

To prevent the purulent conjunctivitis of the new-born, obstetricians counsel a sort of maternal prophylaxis (antiseptic vaginal injections before and during the accouchement); and some would extend this prophylaxis to the infant by bathing its eyes, as soon as born, with some antiseptic solution. Lemon-juice in instillations has been used for this purpose, as well as insufflations of iodoform powder. The latter is always well tolerated, and does not produce any inflammatory reaction.

Special Therapeutics of the Inflammations of the Eye.—To complete the notions which have

been stated, we shall indicate briefly the principal treatments in use in the hospitals in Paris to combat the inflammations of infectious nature which have their seat in the membranes of the eye.

CONJUNCTIVITIS.

Catarrhal conjunctivitis should be treated, as we have said, by instillations of nitrate of silver, and compresses wet in boric water.

Granular conjunctivitis has been most successfully treated by repeated touchings with crayons of subacetate of lead, sulphate of copper, or even mitigated nitrate of silver (the excess of silver salt is neutralized by bathing the eye with a little salt and water). To this you may add antiseptic douches (boric or carbolic water), or you may perform massage of the lids after the introduction of a little red-precipitate ointment. Insufflations of finely powdered iodoform may also be used.

Purulent conjunctivitis is treated by M. Budin with lotions of naphthol α (3 grains to one quart of distilled water), concurrently with cauterizations with nitrate of silver.

M. Kirmisson, after having rid the conjunctiva of pus by an antiseptic lavage, makes a cauterization with a solution of nitrate of silver ($\frac{1}{10}$ or $\frac{1}{30}$), or with the crayon mitigated one-third by the addition of starch. The excess of the nitrate is neutralized by a solution of common salt. The cauterizations are

made once or twice in the twenty-four hours. To this are added douches with an antiseptic solution, and in the interval the lids are covered with compresses wet with the same solution, and these are sometimes covered with a little bag of ice.

BLEPHARITIS.

Trousseau treats this affection by applying every hour compresses wet in the following solution:

Zinc. sulph.	1 part.
Aquæ destil.	100 parts.

Lavages with warm boric water are necessary to detach the concretions which form during the night at the base of the cilia.

An ointment of oxide of zinc and vaselin, 1 part to 10, may also do good service.

In the chronic forms we employ ointments of binoxide of mercury and acetate of lead, with a little oil of cade, tincture of benzoin, etc.

In the blepharitis accompanying pityriasis, Trousseau uses compresses wet in a solution of sulphate of zinc (1:100), applied morning and evening for ten minutes. During the night the border of the lids is smeared with a mixture of vaselin and lanolin, or with an ointment of red precipitate or the yellow oxide of mercury, resorcin, or phenic acid.

In ulcerous blepharitis he employs phenic acid or corrosive sublimate in weak solution, on warm compresses applied for one-half hour twice a day. To

this are added cauterizations with nitrate of silver (crayon or solution), or tincture of iodine if the ulcers are torpid.

In the blepharo-conjunctivitis of infants, Saint Germain and Valude use the following collyrium:

Sulphate of zinc	1 part.
Rose-water......................	50 parts.
Distilled water..................	150 parts.

KERATITIS.

Trousseau treats phlyctenular keratitis by introducing, by means of a camel-hair pencil, a certain quantity (size of a grain of wheat) of the following ointment:

Yellow oxide of mercury	0.25
Vaselin.............................	5.00

Besides, compresses soaked in boric solution are applied three times a day for a quarter of an hour. The compresses may also be wet in chloral water.

Frictions over the orbit with mercurial-belladonna ointment, and cod-liver oil internally, complete the treatment. The patient is kept in a dark room, and complications are treated according to indications.

IRITIS.

Concurrently with instillations of atropine, warm compresses wet in the boric solution are applied three or four times a day. During the night the compresses are replaced by a wad of absorbent cotton.

Be sure to avoid exposure to cold, which exasperates the iritis.

Inunctions of mercurial-belladonna ointment will calm the pain; iodide of potassium will combat the exudations, and bromide or chloral the insomnia. In the suppurative form, give sulphate of quinine internally.

Treat the cause—syphilis, gout, rheumatism, etc.—with the appropriate medication.

CHAPTER IX.

ANTISEPTIC TREATMENT OF DISEASES OF THE THROAT, NOSE, AND EARS.

The antiseptic treatment of diseases of the nasal fossæ, pharynx, and ears, has made considerable progress during the last twenty years. Here, as in all other branches of the healing art in these days, the methods of exploration and of treatment are thoroughly subjected to the rules of antisepsis and asepsis.

Baths or irrigations, sprays or injections (nasal douche), serve to bring the different antiseptic liquids into contact with the nasal mucosa, and to wash away the pus, the microbes and all the products of inflammation which may sojourn in folds of the anterior or posterior nares. The procedures and apparatus devised for this end are described in all special treatises. Sprays constitute an excellent means for bringing the liquid in a finely divided form into contact with the mucosa, and are particularly useful in the treatment of children, who hardly tolerate the nasal douche. These are made by means of appropriate end-tips and cannulæ, by way of nose or mouth, according to indications. Camel-hair pencils, and sponge probangs with flexible stems, may be soaked in the same liquids and carried to the parts it is desired to medicate. Lastly, the fine impalpable powders are frequently employed, and may be projected upon the

part by means of suitable powder-blowers. The caustics may be used in the form of crayons or solutions.

The liquids employed for the baths and douches should be tepid.

The solutions employed for simple detergent washings are the common salt solution (1 : 100) or weak solutions of bicarbonate of soda, chlorate of potassium, etc. The water should be rendered aseptic by previous prolonged boiling. The douches should be thrown gently, and not harshly and with violence, for fear of penetrating the Eustachian tube or larynx and even contributing to the spread of the inflammation. The lavages are only useful in removing the products of abnormal secretion, which contaminate the mucosa. They should be made with considerable slowness, so that the liquid may easily penetrate all the folds and sinuosities; the pressure should be just sufficient to overcome the resistance due to the friction of the liquid against the walls of the nasal fossæ; an almost horizontal direction should be given to the jet.

The antiseptic or disinfectant solutions which are ordinarily employed are: phenic acid (1 to 5 per 1000), permanganate of potash (1 per 10000), boric acid (1 to 3 per 100).

The powders used are boric acid, iodoform, aceto-tartrate of aluminum, and nitrate of silver. The latter should be mixed with starch in variable proportion (½ to 10 per 100). Tannin and many other antiseptics may be employed in powder form.

The caustics are applied to the diseased points by means of a silver probe. Such are chloride of zinc, chromic acid, and nitrate of silver. The galvano-caustic is also employed.

The air-douche, applied by means of a Politzer air-bag, is chiefly employed in affections of the naso-pharynx, Eustachian tube, and middle ear.

In the chronic affections of the naso-pharynx, and in ozæna, we often have recourse to painting with iodized glycerin, the formula of which is as follows:

Iodine	2.5 to 5.0
Iodide of potassium	30.0
Glycerin	250.0

Lastly, among the antiseptics employed less frequently we may mention chloroform, employed to kill the parasites of the nasal fossæ, lime-water (in nasal diphtheria), ichthyol (in acute coryza), iodide of potassium (in nasal syphilis), menthol (as an anæsthetic of the mucosa), papayotin (in local diphtheria), resorcin (in ozæna), and thymol (in solution for irrigation), etc.

ANTISEPTIC TREATMENT OF DISEASES OF THE EARS.

The cleansing of the external auditory passages ought always to precede every intervention, medical or surgical, and even every exploration for diagnosis. For this purpose, warm boiled water and a rubber hand-ball syringe are necessary. Solutions of boric

or salicylic acid may be required; and if there exist a fetid otorrhœa, phenic acid or corrosive sublimate will fulfill the indication. A solution of sulphate of soda (5:100) opposes the coagulation of the secretions. Injections should always be made under feeble pressure to avoid the vertiginous attacks that follow compression of the tympanum. A probe with a little absorbent cotton wrapped around the end completes the cleansing and serves to dry the auditory canal. If there are concretions adherent to the walls, a solution of bicarbonate of soda (1 to 2 per cent.) facilitates their softening.

The air-douche applied by the aid of the Politzer air-bag is both a device of diagnosis and a means of treatment. By mediate auscultation it enables us to determine the degree of permeability of the tube, and to know if the air penetrates the middle ear. Besides, this douche clears away the liquid effused into the tympanum, which may flow out by the tube or by the opening of the tympanum, provided the membrane be perforated. From a more general point of view it has a real antiseptic rôle, by drying the secretions and favoring the regression of the local hyperæmias. It may also serve to convey into the middle ear certain medicinal vapors (vapor of water and of hydrochorate of ammonia—little employed to-day).

To insufflate into the tympanum the vapors of iodide of ethyl, of menthol, of chloroform, of ether,

of turpentine, aural surgeons make use of a special apparatus called the *insufflation capsule.*

Medicinal liquids may be carried up to the tympanum by the aid of the Eustachian catheter to which is adapted a Pravaz syringe or a small rubber hand-ball. By a full insufflation the liquid is injected into the middle ear. In cases of perforation of the tympanum, we inject by the tube a liquid which washes away the secretions accumulated in the cavity, and which flow out by way of the external auditory meatus.

The insufflation of powders is employed in treatment of suppurations of the middle ear. Boric acid and alum finely pulverized, calomel, salol, etc., have been successively used.

Solutions of corrosive sublimate (1:10000) and of nitrate of silver serve also in the treatment of suppuration of the middle ear. Recently, camphorated salol has been proposed by M. Pegon under the form of a pasty liquid with this composition:

Salol............................	2 parts.
Camphor....................	3 parts.

A little absorbent cotton is soaked in this mixture, and passed by means of a probe to the bottom of the ear (as near as possible to the diseased point), and the application may be renewed two or three times a day. Each application is preceded by a boric acid injection.

Tetra-borate of soda was introduced into therapeutics by Jaënicke; it is a well defined product, more

antiseptic than boric acid, and quite soluble in cold and very soluble in warm water. Both acute and chronic otorrhœa have been treated with success by means of this new antiseptic (Kafemann).

Sulphate of zinc, perchloride of iron, sulphate of copper, etc., have been employed in affections of the middle ear. Alum in powder or concurrently with solution of nitrate of silver renders service in the same circumstances, while iodoform does not give good results. The latter may, however, be advantageously employed, either alone or in conjunction with the phenic solutions, for the dressing of abscesses of the mastoid process after puncture and evacuation of the pus. These abscesses should be opened and treated conformably to the rules of surgical antisepsis, like any other abscess situated in a bony region communicating with the exterior. A dressing of iodoform gauze may be used with advantage in such cases.

CHAPTER X.

ANTISEPSIS IN ACCOUCHEMENTS AND IN GYNÆCOLOGY.

One of the principal antiseptics employed in gynæcology is boric acid in saturated solution (4: 100). Boric acid is a feeble antiseptic, but very useful for large injections on account of its absolute innocuousness, and serves for intra-uterine as well as vaginal injections. It should be dissolved in boiled (*i.e.*, sterilized) water. Borated vaselin (4: 100) is the favorite antiseptic ointment of obstetricians.

Phenic acid has long been employed. Strong solutions are only to be used when a caustic action is desired. A 2-per-cent. solution is suitable for cleansing wounds and as a lotion for cutaneous diseases. Phenic acid, being but little soluble in water, is generally dissolved by the help of alcohol or glycerin. The essence of thyme masks its odor. In obstetric practice one drachm of the concentrated phenic acid may be mixed with a drachm of glycerin and dissolved in a pint of hot water; this solution suffices for vaginal and even intra-uterine injections, but it should be allowed to flow freely out again after being injected. The concentrated phenic acid should contain just enough alcohol to keep it liquid, *i.e.*, about 10 per cent.

Salicylic acid (1 to 2 : 100) is but little employed in gynæcology.

Alum is a feeble antiseptic; a common astringent vaginal injection is made by dissolving a heaping teaspoonful in a pint of water.

Nitrate of silver is employed chiefly to cauterize the tissues. The solid stick brushed over diseased surfaces was formerly a favorite application in cervical endometritis and erosions of the os. It has largely gone out of use. As a preventive treatment of the purulent ophthalmia of new-born babies it is employed according to Credé's method: at the moment of birth a few drops of a 2-per-cent. solution are instilled between the eyelids. The black stain which it leaves on the skin and the linen makes it extremely objectionable, in ordinary practice, for the antiseptic treatment of the genital organs.

Chloral in solution (1 to 2 : 100) is too irritant for general use. Has been prescribed for pruritus vulvæ.

Liquid chloride of lime (1 : 10) is chiefly employed for the disinfection of chamber-vessels and water-closets. Chloride-of-zinc solution (1 : 100) may be substituted for it.

Creolin in solution (1 to 2 : 100) is little toxic, and does not corrode instruments. A 3-per-cent. solution is said to have an antiseptic power equal to that of corrosive sublimate 1 : 1000.

Creasote has the property of coagulating albumen and of exercising a caustic action to a certain depth.

It is useful after curetting, as a mildly caustic application to the uterine mucosa.

Creasote may be employed pure or in solution with alcohol and glycerin. A strong solution consists of equal parts of these substances. A weaker solution, much in use, contains one part of creasote and one of alcohol to eight of glycerin.

Iodoform is an excellent antiseptic, and almost indispensable in all the operations of gynæcology. Its favorable action on suppuration and ulcerations is manifest, and assures for it an incontestable superiority over all the other dry antiseptics. A good vaginal suppository is made as follows:

Iodoform	1.0
Glycerin	8.0
Cacao butter	q. s.

For one suppository. To be introduced into the vagina or uterus after accouchement.[a]

Iodoform gauze and iodoform cotton are in daily use in gynæcology, despite the unpleasant odor thereby imparted to hands, instruments, and garments.

Iodoform-glycerin (1 part iodoform to 4 of glycerin) is useful for soaking vaginal tampons to modify ulcerations or erosions of the os uteri.

Iodoform is also employed in powder for a dressing for wounds, being applied by a powder-blower or dusted over the parts.

Iodol is void of odor, and may be substituted for iodoform in ordinary practice, being less likely to

produce toxic accidents, though possessing a feebler antiseptic power.

Iodine, under the form of tincture of iodine, is employed as a caustic for painting the cervix uteri.

Ichthyol (sulpho-ichthyolate of ammonia) pure, or in solution in glycerin, is employed for the same purposes. By its siccative action it modifies advantageously the uterine and vaginal secretions, and it enters into the composition of many topical remedies.

Corrosive sublimate is very much employed in watery solutions. Van Swieten's solution is 1 per 1000. The formula is as follows:

Bichloride of mercury...............	1.0
Alcohol...........................	100.0
Water.............................	900.0

For ordinary injections the saline solution may be used:

Bichloride of mercury.............	1.0
Chloride of sodium................	5.0
Water..........................	1000.0

This solution, made with sterilized water, should be diluted with an equal quantity of boiled water for vaginal injections, and for irrigations during operations. The sublimate tablets, each containing ½ gramme (7½ grains), are very convenient for obstetric practice. One of these dissolved in a pint of water makes the 1:1000 solution. Surgical instruments should not be kept in the sublimate solutions during

operations, but in a boiled carbolic solution, which will not tarnish them.

Naphthol β may be employed in solution of 1 per 1000 when poisoning by corrosive sublimate or carbolic acid is feared. One gramme of naphthol β may be dissolved in 50 of alcohol and 950 of water for ordinary use.

Permanganate of potash in solution is a good antiseptic which has no disadvantage except that it stains the skin and the linen red. Fifteen grains (1 gramme) to the pint makes the strong solution, 15 grains to the quart the weak solution. [The latter is a good antiseptic in obstetrical practice.]

Salol in powder or in the form of crayon is employed in the treatment of ulcerations and in endometritis.

Sulphate of copper in 1:1000 solution is of feeble toxicity, and may be employed in vaginal or uterine injections when corrosive sublimate is contra-indicated. Sulphate of zinc, less active, is often prescribed in leucorrhœa of blennorrhagic origin, or in simple leucorrhœa.

Thymol is of too high a price to enter into ordinary practice.

Microcidine (a compound of naphthol β and soda) is very soluble and little toxic. It is used in obstetric practice for vaginal and uterine injections before and after accouchement, in 4:1000 solution.

Obstetrical Antisepsis.—The obstetrician of

to-day hardly needs enlightenment as to all the preliminary precautions in the way of personal cleanliness and antisepsis necessary before he attempts the care of a puerperal woman. The same care is obligatory on the nurses and other attendants. When an obstetrical operation is to be performed, the most rigid antisepsis of hands and instruments is demanded.

The physician in charge of the lying-in woman should keep his finger-nails cut short and scraped; they should be scrubbed with the nail-brush and soap-suds. The sleeves must then be rolled up and fastened above the elbows, and the hands and forearms scrubbed with hot soap-suds, and the hands dipped in a 1:500 sublimate solution; then, when examinations are to be made, the fingers and the back of the hand should be greased with boric vaselin. These are precautions which are regarded as indispensable by such distinguished obstetricians as Auvard and Tarnier, and, in fact, by all the best authorities all over the world.

The sublimate solutions should always be extemporized at the moment, and for this purpose the little tablets prepared by Parke, Davis & Co., Fraser, Killgore, and others, and which generally contain a little tartaric acid to favor solution, and a little coloring material, are very convenient. Fifteen of the one-grain tablets to a quart of filtered or boiled water makes the 1:1000 solution.

Instruments.—The instruments should be kept

just prior to and during the operation (when not needed) in a boiled carbolic solution. They should always be sterilized before use by immersing them ten minutes in boiling water. After being used they should be plunged into cold water, which, by preventing the coagulation of albumen, renders them more easily cleaned.

Some, for greater precaution, pass their instruments through the flame of an alcohol lamp or sterilize them by the heat of the dry stove, before using. As far as possible, surgical instruments should be entirely of metal, as the horn or wood of the handles alters by heat and contact with water and presents less security than the metallic handle.

Most authorities regard the dry-heat stove as the best means of sterilization. The heat should not exceed 150° C. (300° F.), otherwise the temper of the instruments will be destroyed. The sojourn in the dry-heat stove should be half an hour. Instruments not metallic can be sterilized in a 1: 1000 sublimate solution. Gauze (simple or iodoform) and absorbent cotton are kept in aseptic boxes hermetically closed. Sponges should undergo a quite special preparation, and then be kept in perfectly tight glass vases.

Simple Accouchement.—Preventive antisepsis during the last few weeks of pregnancy is a good precaution. It is absolutely indispensable if there are hæmorrhages or other discharges during gestation, whatever may be their cause; it is a fact of

common observation that post-partum accidents are more common in women who have had leucorrhœal and other discharges during pregnancy.

During the last fortnight, then, the physician will see that the vulva is occasionally washed with soap and water, and that a vaginal injection of corrosive sublimate, 1 : 4000, is made. For these injections, a fountain syringe with hard rubber or celluloid cannula is desirable; this should hold at least two quarts, and when used is suspended on the wall a few feet above the bed, so that the liquid may flow through the long rubber tubing by the force of gravity. A suitable tube-nipper will arrest the flow when desired.

At the moment of accouchement the nurse will bathe the external genitals with soap and water and make an antiseptic sublimate injection.

Whenever the accoucheur makes a vaginal examination he will take the same antiseptic precautions as before indicated, and will grease the finger with borated vaselin. He will make as few examinations as possible. When the head appears at the vulvar orifice, he will have at hand a sublimate solution 1 : 2000, and wads of absorbent cotton dipped in this solution, with which he will from time to time wipe the external genitals. If there be expulsion of fæcal matters, these are at once removed and the parts antiseptically cleansed. All the genital region, within and without, may be greased with the borated vaselin; this may facilitate the escape

of the fœtus and protect the skin of the region. A careful cleansing of the vulva will follow the delivery.

When the antisepsis has been well carried out during pregnancy and accouchement, the injections (even vaginal) will often be unnecessary after confinement. All that need be done is to keep antiseptic pads (wrung out in sublimate solution and dried) over the external genitals. Iodoform or corrosive-sublimate gauze will answer the purpose. If vaginal injections are indicated on account of the lochia becoming offensive, they may be made with the 1-per-cent. carbolic solution.

Application of Forceps; Version; and Other Operations.—All the operations necessitating the introduction of the hand or instruments into the uterus demand an antisepsis much more strict than does simple accouchement.

The woman being placed in the proper position, and rendered aseptic by the lavages and injections above indicated, the forceps are passed through the flame, then plunged into boiling water and greased with vaselin. When they are removed, after delivery, they are at once placed in cold water before being cleansed.

It is a good plan, after an application of the forceps, especially at the superior strait, to follow delivery by an intra-uterine injection of carbolic solution, 1:100.

In case of version, the hand and forearm to the

elbow must be rendered aseptic, then greased with borated vaselin.

Lastly, when all is completed, there should be an antiseptic lavage of the vulva, vagina, and uterine cavity.

Tarnier, in one of his recent obstetrical lectures, has shown the brilliant results which have followed antiseptic midwifery: "Eight years ago [in the Maternity], out of 1340 lying-in women there were 33 deaths (a mortality of 2.50 per 100); to-day, with more rigid antiseptic care, the mortality has fallen to 1.04 per 100."

[Much more startling statistics could be furnished, if it were deemed necessary to compare present practice with the old-time practice. In fact, in all our leading lying-in hospitals, puerperal fever, once such a scourge, is nearly exterminated.]

Tarnier employs in his "Maternity" corrosive sublimate (1:5000); sulphate of copper (5:1000); permanganate of potash (½ gramme per 1000); phenic acid (20:1000); and lastly, microcidine (4:1000). He prefers the latter as the best known antiseptic after corrosive sublimate.

ANTISEPSIS IN OPERATIVE GYNÆCOLOGY.

The antiseptic precautions which concern the operator, his assistants, and his instruments, are the same as in instrumental obstetrics, and need not here be repeated.

Digital exploration should not be made until after washing of the vulva and vagina and an antiseptic injection. The exploring finger should be first well disinfected, and greased with boric vaselin.

The speculum should be rendered thoroughly aseptic, and plunged in cold water immediately after being used. Then it should be cleansed, wiped with a dry cloth, and immersed for a time in a strong phenic solution. In cases of vaginitis or of any venereal affection, it will be well, besides the other antiseptic precautions, to pass the speculum through the alcohol-flame.

The uterine sound and all the other instruments should be also rendered aseptic. These instruments should never be introduced into the uterus without an antiseptic vaginal irrigation, made with care, the speculum being in place in order that the injection may penetrate all the folds of the mucosa.

Dilatation of the cervix is made by means of prepared sponges or sea-tangle tents. These laminaria tents should be rendered aseptie by soaking them four days in a saturated solution of iodoform-ether, from which they are not removed until they are needed. Their application should be made with the same precautions as in the introduction of the uterine sound.

Vaginal and Uterine Topical Agents.—These are tampons, suppositories, ovules, crayons, strips of gauze, etc. Tampons are very much used in gynæcology, and are made of little rolls of absorbent cot-

ton or antiseptic wool, moulded to fit the vagina, and tied, kite-tail fashion, with an aseptic string, and soaked in glycerin or any other medicated liquid. The string hangs outside the vulva, and enables the woman to withdraw the tampon after from twelve to twenty-four hours.

Suppositories have over tampons the advantage of melting slowly without leaving any other residue than that which can be removed by an injection. The following is a favorite with M. Auvard; it is employed in the sequelæ of accouchements with menace of septic accidents:

Iodoform	1.0
Glycerin	8.0
Cacao butter	q. s.

M. For one suppository. (This may also be useful in gynæcology.)

Ovules are destined to replace tampons and suppositories. They are made in moulds by the aid of glycerin jelly, and their forms are very varied. They are introduced by the patient, and generally kept in all night, *i.e.*, between two injections. They produce quite an abundant discharge. These ovules may be medicated with boric acid, tannin, iodoform, chloride of zinc, resorcin, salol, ichthyol, aristol, etc.

This kind of dressing exercises its action not only on the vagina, but on the uterus and its annexes.

Crayons, of harder consistence than the ovules, and of another form, serve to introduce the antiseptics

into the cavity of the cervix and of the uterus. Various antiseptics may be incorporated in them, as iodoform, ichthyol, camphorated salol, chloride of zinc.

Gynæcologists also introduce liquid caustics, as nitric acid, into the cavity of the uterus, notably in endometritis, in order to cauterize the mucosa and produce by a chemical process an eschar which replaces mechanical curettage.

Antiseptic gauze (iodoform, corrosive sublimate) is also employed to tamponade the vagina, and even the uterus, in *post-partum* hæmorrhages, and in gynæcology after curetting. It acts as an antiseptic and as an obturating and protective tampon.

Curettage of the Uterus.—This operation, which necessitates taking chloroform and bringing down the uterus to the vulvar orifice, is of very frequent performance in gynæcology.

The cervix is first dilated with iodoform laminaria tents, or the steel dilator of Ellinger or Sims. All instruments must be thoroughly aseptic, and vulva, vagina, and cervix must before and during the operation be irrigated with sublimate solution (1:2000 or 1:4000).

After curetting is completed, the uterus is swabbed out with a solution of creasote and glycerin (one part creasote to five parts of glycerin). A platinum uterine probang serves for this purpose. Then a final lavage of the uterus and vagina is made with a stronger sublimate solution (1:1000). A strip of

iodoform gauze impregnated with glycerin is then carried up to the fundus uteri, and the extremity allowed to hang out of the vagina. An iodoform tampon is then placed in the vagina through the speculum, and left there for three .days; at least, it is not removed until it is soaked with the discharge. Iodoform is, thus far, the best antiseptic in our possession for shielding the parts from the septic influence of these discharges and for staying the production of pus in general. For this purpose, despite its disagreeable odor, it is still to be preferred in gynæcological operations.

PART III.

*ANTISEPTIC HYGIENE OF PATIENTS AND THEIR ENVIRONMENT.**

BODILY HYGIENE OF THE PATIENT.

Cleanliness of the body, obtained by frequent ablutions with pure water, is the most important of all hygienic requirements. Asepsis must precede antisepsis, for in many cases it precludes the necessity of the latter. In sickness, cleanliness becomes even more necessary, both for the patient, who is a subject of auto-infection, and for his attendants, who are exposed to the contagion.

As sick persons are seldom in a condition to carry out the necessary hygienic requirements for themselves, it is the more important that the medical attendant should obligate on others duties, even the most elementary, which pertain to the cleanliness as well as the proper aëration and disinfection of the sick. The preoccupation of the disease, and the mental and physical prostration, generally render the patient indifferent to all that does not immediately concern his sufferings; and it is undeniable that families and people at large do not yet understand the importance of frequent ablutions and changes of

*I have taken some liberties with this chapter, especially in the way of abridgement.—TRANSLATOR.

under-apparel, of bed-clothes, etc., for the sick. Many a feverish patient who should have an abundance of fresh air and be lightly covered with bed-clothes, is found on the doctor's arrival to be smothered with blankets and kept in a room from which all pure air is rigorously excluded by keeping the doors and windows shut.

It is the physician's duty to enlighten the public as to the importance of correct hygiene for the sick as for the well, and he will not consider even the minor details of bodily hygiene as of little moment, for they may count for considerable in the final result.

The physician, then, cannot too much insist on the necessity of daily ablutions—once or twice—performed in a way not to unduly fatigue the patient. Even in eruptive fevers such ablutions are necessary, and they should be made with tepid water. The hair should be well combed, and on certain occasions (fevers, meningeal affections) cut short. The beard should be well trimmed. The bed-clothing and underwear should be frequently renewed. This is especially urgent in dysentery and typhoid fever.

The air of the room should be continually renewed, and when the season of the year will permit, the windows should be kept open, for oxygen is the best of antiseptics. The temperature of the room should not be too high nor too low; for most occasions a temperature of 65° F. (18° C.) is sufficient. A

stove in a sick-room is bad; an open fire-place is far preferable.

Hygiene of the Mouth.—The cleansing of the mouth, always important, should be done oftener and more thoroughly in sickness than in health.

In a great many affections, relapses or complications are attributable to the microbes which the patients have conserved in their mouths, a culture field eminently favorable to their multiplication. This is particularly true of the pneumococcus, or microbe of pneumonia; pneumococcus angina frequently succeeds a frank pneumonia. The dental caries which follows grave fevers, particularly typhoid fever, is only a consequence of neglect of the mouth and teeth. In anginas of all kinds, gargles and irrigations are obligatory, and the mouth should be well rinsed and scrubbed; in fact, mouth-rinsing after each meal was a custom of our fathers which it would be hygienic for the present generation to continue. English ladies have the habit of cleansing the mouth before going to bed, and certainly the custom is worthy of general adoption. This mouth-washing not only removes débris of food which lodges between the teeth and menaces their soundness, besides getting up a fermentation under the influence of the saliva, but it also renders the mouth less likely to be a culture field for microbes which only await a suitable occasion to become pathogenic. Dujardin-Beaumetz recommends the following mouth-wash:

Phenic acid	1.0 Gm.
Boric acid	25.0
Thymol	0.50
Essence of peppermint	20 drops.
Tincture of anise	10.0 Gm.
Water	1 litre.

Rinse the mouth and scrub the teeth with water containing an equal quantity of this solution: do this after each meal. Brushes that are soft are to be pre-erred. I cannot approve of the ordinary dentifrice powders; a toilet napkin soaked in the antiseptic liquid will always suffice. Hard brushes irritate the gums and make them bleed; dentifrices are likely to wear away the enamel, and make a way of entrance for the microbes of dental caries.

Thomas has made a special study of antiseptic dentifrices, and prefers thymic acid, 1 per 2500. His formula is as follows:

Thymic acid	0.25
Benzoic acid	3.00
Tincture eucalyptus	15 00
Alcohol	100.00
Essence peppermint	0.75

A feeble antiseptic for rinsing the mouth. The following contains corrosive sublimate, and is stronger:

Thymic acid	0.15
Corrosive sublimate	0.80
Benzoic acid	3.00
Tiucture eucalyptus	15.00
Alcohol	100.00
Essence peppermint	0.75

A few drops of these solutions in a half-tumbler of water suffice for the mouth-wash. The tooth-brush when not in use must be kept in an antiseptic liquid.

One of the best and oldest of formulæ for the prevention of dental caries is the *Eau de Botot:*

	Parts.
Anise seeds	64
Canella	16
Cloves	1
Pyrethrum	4
Cochineal	5
Cream of tartar	5
Benzoin, Myrrh } ää	2
Essence of peppermint	4
Alcohol	2000

Rub up the solid ingredients into a fine powder, add the alcohol, and macerate eight days.

A teaspoonful to a glass of water makes the dentifrice solution. The habitual use of this solution prevents decay of the teeth, and often averts the fluxions and consequent toothache so frequent in persons who have carious teeth.

For antisepsis of the digestive tube, employ salicylate of bismuth, salol, naphthol, benzonaphthol, conformably to the rules before laid down.

HYGIENE OF NURSES AND OTHER ATTENDANTS ON THE SICK.

Nurses and others that have the care of the sick should take all the precautions which belong to gen-

eral hygiene, and, when called to accouchements or to assist in gynæcological or surgical operations, should make all the antiseptic preparations and rigorously carry out the rules which I have indicated under the head of Antisepsis in Obstetrics and Gynæcology.

They ought to wear special garments appropriate for the services which they render the patient; these should be laid aside when they quit the sick-room. Nurses must take sufficient rest, sleep, recreation, and nourishment to keep them in their best efficiency. In no case may they eat their meals in the sick-room. I would say to such persons: "Wash your hands whenever you touch the sick person or his dejections; use a solution of sublimate or thymol, 1 per 1000. Cleanse and scrape the nails often; wash frequently the face, hair, and beard, and take a full bath every day. Every day take a hygienic walk of a mile or so in the open air."

The physician will see to it that the patient is not exposed to danger by visitors who have not taken any pains to disinfect themselves. This remark is especially applicable to obstetric attendance. The germ of puerperal septicæmia may be brought by a person unconscious of the danger which his or her presence entails on the lying-in woman. A physician, in a recent medical journal, relates an instance where, after having taken the most minute antiseptic precautions such as are now-a-days always recommended in such cases, he was shocked to see his

patient attacked with puerperal fever a few days after her confinement. On inquiry, he found that the mother of the lying-in woman had, a few days before, passed several hours in the room of another woman who had died of puerperal fever, and had even assisted in laying out the body. Persons affected with cancer, with chronic suppuration, etc., should not be allowed to enter the room of the sick person.

The isolation of the patient, so desirable for himself as well as for persons who are well, is possible at hospitals, but can only be carried out imperfectly in private practice. The most that the physician often can do is to forbid persons who come only from curiosity, and particularly young children, who are predisposed to contract contagious diseases, to enter the sick-room.

Cleanliness of the hands is one of the most necessary conditions for the prevention of contagion by persons who handle the sick. Beside the lotions previously indicated, the sulphur soaps, carbolic soaps, etc., the following Aromatic Lotion may render service:

Carbolic acid....................	1 part.
Alcohol........................	4 parts.
Distilled water..................	100 parts.

Antisepsis of the Sputa.—Especial attention should be given to the disinfection and disposal of sputa, especially of the sputa of phthisical patients. The patients should be forbidden to spit in a handker-

chief. If this cannot be prevented, all infected handkerchiefs or cloths should be immediately burned. The only way to render them safe for future use is to boil them in water or in some antiseptic solution. The patient should not be allowed to expectorate on paper. The paper, generally a piece of newspaper, easily tears between the fingers of the patient, who then wipes them on a towel or even on the bed, clothes. The only spittoon to be recommended is one of porcelain or crockery, furnished with a movable cover; this should be half-filled with a solution of corrosive sublimate 1 or 2 per 1000, and should be emptied and cleansed at least twice in the twenty-four hours. The contents of the spittoon having been emptied into sawdust and immediately burned, the spittoon should be washed with a sublimate solution, or at least well scalded out with water. Only dried sputa are dangerous. The point of caution should therefore be to destroy the moist sputa before the process of evaporation has time to liberate the germs to be carried about in the form of dust.

Antisepsis of the Skin in Exanthematous Fevers.— To prevent the dissemination of epidermic scales dried and reduced to powder in eruptive fevers, it is a good plan to grease the skin with borated or sublimate vaselin. This precaution prevents the patient from inoculating himself by scratching, and in many cases it aborts the papules or prevents them from suppurating. Besides, it prevents contagion by the dried scales during desquamation.

A child that has had any eruptive fever (measles, scarlatina, smallpox), during the period of convalescence and for some time after recovery should take a soap and-water bath every day. These baths should be preceded by thorough rubbing of the hairy scalp with sweet oil or borated vaselin so as to detach all the epidermic scales. The child will not be in a condition to send to school till twenty-five days after the onset of the disease, in case of measles, and forty days in case of scarlatina or smallpox.

Antisepsis and Disinfection of the Dejections.— All chamber vessels and water-closets should be kept clean and disinfected with antiseptic solutions, among which there is nothing better than the solution of sulphate of copper, 5 per 100. This solution is very much cheaper than carbolic acid, and is free from odor.

ANTISEPSIS AND DISINFECTION OF HOUSES.

When you have to do with contagious diseases, the disinfection of the bedding and clothing of the patient and of the sick-room should be done with the greatest care when the disease is ended.

It is well at the onset of any long or dangerous disease that the curtains and carpets should be removed, and in fact everything that can intercept germs or hinder the free circulation of air.

The bedding and every article of clothing that has been contaminated by the dejections of the pa-

tient should be disinfected and cleansed. This disinfection should be made in the hot-air stoves in which steam is made to act under high pressure. The movable hot-air stoves are useful where there are no establishments for dry-heat disinfection open to the public, such as we have in Paris.

The disinfection of the sick-room may be effected in different ways: by chlorine, by sulphur fumigations, and by corrosive sublimate. The latter tends more and more to replace the other agents of disinfection, being less offensive than sulphur or chlorine, and being little expensive. Thus, where disinfection, to be complete, demands 5 kilogrammes of phenic acid, it may be accomplished quite as effectually with one kilogramme of sulphate of copper or 25 grammes of bichloride of mercury.

The solution of corrosive sublimate 1 per 1000 is much in use in the disinfection of apartments by the squads of disinfectors organized for the city of Paris, who are placed gratuitously at the disposal of the public. Wall papers and hangings, even the wood of the floors, are impregnated with this solution, which penetrates all the chinks, and every part is brushed and rubbed with care. Water-closets, bathtubs, sinks, etc., are also disinfected. I have seen apartments recently treated by this method, and can vouch for the ease with which it can be accomplished and the safety which it confers.

INDEX TO VOLUMES I AND II.

A.

C.

E.

F.

G.

M.

N.

Q.